User Manual

netBRICK NB 100

Gateway Devices

Hilscher Gesellschaft für Systemautomation mbH

www.hilscher.com

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Table of Contents

1 INTRODUCTION 6
1.1 About the User Manual 6
1.1.1 Obligation to read and understand the Manual 6
1.1.2 List of Revisions 7
1.1.3 Conventions in this Manual 8
1.2 Reference to Hardware, Software, Driver and Firmware 9
1.3 Contents of the Product DVD 10
1.3.1 Directory Structure of the DVD 10
1.3.2 Device Description Files 11
1.3.3 Documentation for netBRICK 12
1.4 Legal Notes 15
1.4.1 Copyright 15
1.4.2 Important Notes 15
1.4.3 Exclusion of Liability 16
1.4.4 Warranty 16
1.4.5 Export Regulations 17
1.4.6 Registered Trademarks 17
2 SAFETY 18
2.1 General Note 18
2.2 Intended Use 18
2.3 Personnel Qualification 18
2.4 References Safety 18
2.5 Safety Instructions to avoid Personal Injury 19
2.5.1 Use in Hazardous Locations only in Scope of the UL Standards 19
2.5.2 Danger of unsafe System Operation 19
2.6 Safety Instructions to avoid Property Damage 20
2.6.1 Device Destruction by exceeding allowed Supply Voltage 20
2.6.2 Electrostatically sensitive Devices 20
2.6.3 Danger of unsafe System Operation 20
2.7 Labeling of Safety Messages 21
3 DESCRIPTION AND REQUIREMENTS 22
3.1 Device Description 22
3.2 Device Names 23
3.3 Protocol Conversions 24
3.3.1 Protocol Conversion - Ethernet to Fieldbus 24
3.3.2 Protocol Conversion - Serial Protocols to Fieldbus 26
3.4 System Requirements 27
3.5 Configuration Requirements 27

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3.6 Licenses 28

4 DEVICE DRAWINGS AND CONNECTIONS 29

4.1 Dimensioned Drawing 29

4.2 Drilling Template 29

4.3 Device Label 30

4.4 Positions of LEDs and Control Elements 31

4.4.1 Elements of the netBRICK NB 100-RE-xx Device 31

4.4.2 Elements of the netBRICK NB 100-RS-xx Device 32

4.5 Connections 33

4.5.1 X1 Power Supply PWR 33

4.5.2 X2 Front Connection 34

4.5.3 X3 Fieldbus Connection 36

4.5.4 Diagnostic Interface 39

4.6 Schematic Diagram - Galvanic Isolation 41

4.6.1 Galvanic Isolation NB 100-RE-DP Device 41

4.6.2 Galvanic Isolation NB 100-RE-DN/CO Device 43

4.6.3 Galvanic Isolation NB 100-RS-DP Device 44

4.6.4 Galvanic Isolation NB 100-RS-DN/CO Device 45

5 MOUNTING AND DISMOUNTING 46

5.1 Safety Messages on Personal Injury 46

5.1.1 Use in Hazardous Locations only in Scope of the UL Standards 46

5.1.2 Danger of unsafe System Operation 46

5.2 Property Damage Messages 47

5.2.1 Device Destruction by exceeding allowed Supply Voltage 47

5.2.2 Electrostatically sensitive Devices 47

5.2.3 Danger of unsafe System Operation 47

5.3 Mounting 48

5.3.1 Use in Hazardous Locations only in Scope of the UL Standards 48

5.4 Dismounting 49

5.4.1 Use in Hazardous Locations only in Scope of the UL Standards 49

6 INSTALL DRIVER 50

7 COMMISSIONING 51

7.1 Commissioning 51

7.2 Maintainance 51

7.3 Boot up Behavior 52

7.3.1 Boot up Behavior on valid Firmware 52

7.3.2 Boot up Behavior on invalid Firmware 52

8 TROUBLESHOOTING 61

8.1 Failure in 10 MBit/s Half Duplex Mode and Workaround 62

9 LEDS 63

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9.1 LED SYS 63
9.2 LED APL 63
9.3 LEDs Real Time Ethernet Systems 64
9.3.1 LED EtherCAT Master 64
9.3.2 LED EtherCAT Slave 65
9.3.3 LED EtherNet/IP Scanner (Master) 67
9.3.4 LED EtherNet/IP Adapter (Slave) 68
9.3.5 LED Open Modbus/TCP 69
9.3.6 LED POWERLINK Controlle Node/Slave 70
9.3.7 LED PROFINET IO RT Controller 72
9.3.8 LED PROFINET IO-RT-Device 73
9.3.9 LED sercos Master 74
9.3.10 LED sercos Slave 76
9.4 LEDs Fieldbus Systems 77
9.4.1 LED PROFIBUS DP Master 77
9.4.2 LED PROFIBUS DP Slave 77
9.4.3 LED CANopen Master 78
9.4.4 LED CANopen Slave 79
9.4.5 LED DeviceNet Master 80
9.4.6 LED DeviceNet Slave 80
9.5 LEDs Serial 81
9.5.1 LED Modbus RTU 81
9.5.2 LED ASCII 81
9.5.3 LED 3964R 82

10 TECHNICAL DATA 83
10.1 Technical Data netBRICK NB 100 Gateway 83
10.2 Technical Data Real-Time Ethernet Protocols 87
10.2.1 EtherCAT Master 87
10.2.2 EtherCAT Slave 87
10.2.3 EtherNet/IP Scanner (Master) 88
10.2.4 EtherNet/IP Adapter (Slave) 89
10.2.5 Open Modbus/TCP 90
10.2.6 POWERLINK Controlled Node (Slave) 90
10.2.7 PROFINET IO-RT-Controller 91
10.2.8 PROFINET IO-RT-Device 92
10.2.9 sercos Master 93
10.2.10 sercos Slave 94
10.3 Technical Data Fieldbus Protocols 95
10.3.1 CANopen Master 95
10.3.2 CANopen Slave 96
10.3.3 DeviceNet Master 97
10.3.4 DeviceNet Slave 98
10.3.5 PROFIBUS DP Master 99
10.3.6 PROFIBUS DP Slave 100
10.4 Technical Data serial Protocols 101
10.4.1 ASCII 101

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10.4.2 Modbus RTU Master/Slave 102
10.4.3 3964R 103

11 WIRING INSTRUCTIONS 104
11.1 PROFIBUS 104
11.2 CANopen 106
11.3 DeviceNet 107
11.4 Ethernet 109
11.5 RS-232 110
11.6 RS-422 111
11.7 RS-485 113

12 DECOMMISSIONING/DISPOSAL 115
12.1 Decommissioning 115
12.2 Disposal of Waste Electronic Equipment 115

13 GLOSSARY 116

14 APPENDIX 118
14.1 List of Figures 118
14.2 List of Tables 119
14.3 Contacts 122

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1 Introduction

1.1 About the User Manual

This user manual describes the hardware, installation, commissioning, and operation of the netBRICK NB 100 series of gateways.

1.1.1 Obligation to read and understand the Manual

Important!

- To avoid personal injury and to avoid property damage to your system or to your device, you must read and understand all instructions in the manual and all accompanying texts to your device, before installing and operating your device.
- First read the **Safety Instructions** in the safety chapter.
- Obey to all **Safety Messages** in the manual.
- Keep the product DVD providing the product manuals.

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1.1.2 List of Revisions

Index	Date	Chapter	Revisions
8	2012-11-07		**Firmware Version 1.5.x.x**
		3.5	Section *Configuration Requirements*: Windows 2000 removed, Windows Vista and Windows 7 added.
		9.4.2	Section *LED PROFIBUS DP Slave* updated.
		9.4.4	Section *LED CANopen Slave*: State for baurate detection added.
		10.2.3	Section *EtherNet/IP Scanner (Master)*: - Maximum number of total cyclic input data of 5760 reduced to 5712 bytes, - Device Level Ring as Beacon based ‚Ring Node' supported, - Address Conflict Detection supported.
		10.2.10	Section *sercos Slave*: - Maximum number of cyclic input data and output data reduced from 200 to 128 bytes each, - NRT channel supported: only forwarding and S/IP.
		10.3.2	Section *CANopen Slave*: - Event timer added, - Auto baudrate detection is supported.
		10.3.5	Section *PROFIBUS DP Master*: - Maximum number of total cyclic input data extended from 3584 to 5712 bytes, - Maximum number of total cyclic output data extended from 3584 to 5760 bytes.
		10.3.6	Section *PROFIBUS DP Slave*: Maximum number of modules: Max. 4 input modules and max. 4 output modules, max. 24 modules when using manual setting.
9	2013-02-04	1.3.3	Section *Documentation for netBRICK* updated.
10	2013-06-26	6	Installation program of USB driver added.
11	2014-03-11	1.3.1	Section *Directory Structure of the DVD* updated.
12	2014-03-24	7.3	Paths to DVD updated in section *Boot up Behavior*.
		10.2.5	Section *Open Modbus/TCP*: Information added: ‚Maximum number of connections is 16'.
		11.2	Maximum cable length for 1 MBit/s is 30 m.

Table 1: List of Revisions

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1.1.3 Conventions in this Manual

Operation instructions, a result of an operation step or notes are marked as follows:

Operation Instructions:

➢ <instruction>

or

1. <instruction>
2. <instruction>

Results:

<result>

Notes:

Important: <important note>

Note: <note>

<note, where to find further information>

Safety Messages

For information about the labeling of safety messages refer to section *Labeling of Safety Messages* on page 21.

Numbering

① **...** ⓝ reference to the figure used in that section. If the numbers reference to a section outside the current section then a cross reference to that section and figure is indicated.

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1.2 Reference to Hardware, Software, Driver and Firmware

Hardware

Device Type	Revision	Port X2	Port X3
NB 100-RE-CO	Revision 3	Ethernet	CANopen
NB 100-RE-DP	Revision 3	Ethernet	PROFIBUS DP
NB 100-RE-DN	Revision 4	Ethernet	DeviceNet
NB 100-RS-CO	Revision 3	RS interface	CANopen
NB 100-RS-DP	Revision 2	RS interface	PROFIBUS DP
NB 100-RS-DN	Revision 2	RS interface	DeviceNet

Table 2: Reference to Hardware

Software

Software	Software Version
SYCONnet netX setup.exe	1.351.x.x and higher

Table 3: Reference to Software

Driver

Driver	Software Version
USB Driver	USB Driver of Windows®

Table 4: Reference to Driver

Firmware

Firmware for the protocol conversion: see section *Protocol Conversions* on page 24.

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1.3 Contents of the Product DVD

The product DVD for the netBRICK NB 100 contains:

- Setup program for the configuration and diagnostic program SYCON.net
- USB Driver
- Documentation
- Firmware
- Device Description Files (GSD, GSDML, EDS, ...)
- Video-Audio Tutorials
- Presentation about netSCRIPT (relevant for netTAP NT 100 only)

1.3.1 Directory Structure of the DVD

All manuals on this DVD are delivered in the Adobe Acrobat® Reader format (PDF).

Directory Name	Description
Documentation	Documentation in the Acrobat® Reader Format (PDF)
Electronic Data Sheets (e. g. EDS, GSD, GSDML)	Device Description File
Firmware	Loadable Firmware
fscommand	Files used for installation
Setups & Drivers	Configuration and diagnostic software SYCON.net USB Driver for netTAP NT 100 and netBRICK NB 100 Debugger software for netSCRIPT (relevant for netTAP NT 100 only) Lua for Windows (relevant for netTAP NT 100 only)
Supplements & Examples	Tool for recovery of netTAP 100 devices respectively netBRICK NB 100 devices Examples for SYCON.net Examples for netSCRIPT (relevant for netTAP NT 100 only) Links to websites about Modbus
Training & Podcasts	Videos about commissioning Presentation about netSCRIPT (relevant for netTAP NT 100 only)

Table 5: Directory Structure of the DVD

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1.3.2 Device Description Files

The directory EDS on the DVD provides device description files for the net-BRICK NB 100 device.

netBRICK NB 100 as	File name
CANopen Slave	NB100_CO_COS.eds
DeviceNet Slave	NB100_DN_DNS.EDS
EtherCAT Slave	Hilscher NB 100-ECS-XX V2.2.xml
EtherNet/IP Adapter	HILSCHER NB 100-RE EIS V1.1.EDS
POWERLINK Slave	00000044_NB100PLS-64O_64I.xdd 00000044_NB100PLS-512O_512I.xdd
PROFIBUS DP Slave	HIL_0C9C.GSD
PROFINET IO Device	GSDML-V2.2-HILSCHER-NB 100-RE PNS-20120806-143000.xml
sercos Slave	Hilscher NB100 RE S3S FixCFG FSPIO Default.xml only for default settings. **Note**: Use the SDDML export function in SYCON.net to create a suitable SDDML file.

Table 6: Device Description Files for netBRICK NB 100 on the DVD

The device description files are for the configuration of the used master.

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1.3.3 Documentation for netBRICK

The following documentation overview gives information, for which items you can find further information in which manual.

Note: Further information:

All manuals listed in the overview below can be found in the Documentation directory on the DVD delivered, in the Adobe Acrobat® Reader format (PDF).

Basic documentation for netTAP NT 100

You always need the following documents:

Manual	Contents	Document name
User Manual	netBRICK NB 100 Installation, Operation and Hardware	netBRICK NB 100 - Gateway Devices UM xx EN.pdf (this manual)
User Manual	Software Installation Gateway Solutions	Software Installation - Gateway Solutions UM xx EN.pdf
Operating Instruction Manual	Configuration of Gateway and Proxy Devices netTAP, netBRICK and netLINK Step by step description of the configuration of the netBRICK NB 100. Configuration of the netBRICK NB 100 as EtherCAT Slave, EtherNet/IP Adapter, Open Modbus/TCP, POWERLINK controlled Node, PROFINET IO Device, sercos Slave CANopen Slave, DeviceNet Slave respectively PROFIBUS DP Slave	Configuration of Gateway and Proxy Devices OI xx EN.pdf

Table 7: Basic Documentation for netBRICK NB 100

netBRICK NB 100 with EtherCAT Master

You need the following additional documents, if you use the protocol EtherCAT Master on the gateway device:

Manual	Contents	Document name
Operating Instruction Manual	DTM for EtherCAT Master devices	EtherCAT Master DTM OI xx EN.pdf
Operating Instruction Manual	Generic DTM for EtherCAT Slave devices	EtherCAT Generic Slave DTM OI xx EN.pdf

Table 8: Additional Documentation for netBRICK NB 100 with EtherCAT Master

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netBRICK NB 100 with EtherNet/IP Scanner/Master

You need the following additional documents, if you use the protocol EtherNet/IP Scanner/Master on the gateway device:

Manual	Contents	Document name
Operating Instruction Manual	DTM for EtherNet/IP Scanner devices	EtherNetIP Scanner DTM OI xx EN.pdf
Operating Instruction Manual	Generic DTM from EDS File EtherNet/IP Adapter Devices	EtherNetIP Generic Adapter DTM EDS OI xx EN.pdf
Operating Instruction Manual	Generic DTM for EtherNet/IP Adapter devices	EtherNetIP Generic Adapter DTM OI xx EN.pdf

Table 9: Additional Documentation for netBRICK NB 100 with EtherNet/IP Scanner/Master

netBRICK NB 100 with PROFINET IO Controller

You need the following additional documents, if you use the protocol PROFINET IO Controller on the gateway device:

Manual	Contents	Document name
Operating Instruction Manual	DTM for PROFINET IO Controller devices	PROFINET IO Controller DTM OI xx EN.pdf
Operating Instruction Manual	Generic DTM for PROFINET IO Device devices	PROFINET IO Generic Device DTM IO xx EN.pdf

Table 10: Additional Documentation for netBRICK NB 100 with PROFINET IO Controller

netBRICK NB 100 with sercos Master

You need the following additional documents, if you use the protocol sercos Master on the gateway device:

Manual	Contents	Document name
Operating Instruction Manual	DTM for sercos Master devices	sercos Master DTM OI xx EN.pdf
Operating Instruction Manual	Generic DTM for sercos Slave devices	sercos Generic Slave DTM OI xx EN.pdf

Table 11: Additional Documentation for netBRICK NB 100 with EtherCAT Master

netBRICK NB 100 with CANopen Master

You need the following additional documents, if you use the protocol CANopen Master on the gateway device:

Manual	Contents	Document name
Operating Instruction Manual	DTM for CANopen Master devices	CANopen Master DTM OI xx EN.pdf
Operating Instruction Manual	Generic DTM for CANopen Slave devices	CANopen Generic Slave DTM OI xx EN.pdf

Table 12: Additional Documentation for netBRICK NB 100 with CANopen Master

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netBRICK NB 100 with DeviceNet Master

You need the following additional documents, if you use the protocol DeviceNet Master on the gateway device:

Manual	Contents	Document name
Operating Instruction Manual	DTM for DeviceNet Master devices	DeviceNet Master DTM OI xx EN.pdf
Operating Instruction Manual	Generic DTM for DeviceNet Slave devices	DeviceNet Generic Slave DTM OI xx EN.pdf

Table 13: Additional Documentation for netBRICK NB 100 with DeviceNet Master

netBRICK NB 100 with PROFIBUS DP Master

You need the following additional documents, if you use the protocol PROFIBUS DP Master on the gateway device:

Manual	Contents	Document name
Operating Instruction Manual	DTM for PROFIBUS DP Master devices	PROFIBUS DP Master DTM OI xx EN.pdf
Operating Instruction Manual	Generic DTM for PROFIBUS DP Slave devices	PROFIBUS DP Generic Slave DTM OI xx EN.pdf

Table 14: Additional Documentation for netBRICK NB 100 with PROFIBUS DP Master

netBRICK NB 100 with ASCII

You need the following additional documents, if you use the ASCII protocol on the gateway device:

Manual	Contents	Document name
User Manual	ASCII Handshake Mechanism	ASCII – Handshake Mechanism UM xx EN.pdf

Table 15: Additional Documentation for netBRICK NB 100 with ASCII

netBRICK NB 100 with 3964R

You need the following additional documents, if you use the 3964R protocol on the gateway device:

Manual	Contents	Document name
User Manual	3964R Handshake Mechanism	3964R – Handshake Mechanism UM xx EN.pdf

Table 16: Additional Documentation for netBRICK NB 100 with 3964R

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1.4 Legal Notes

1.4.1 Copyright

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1.4.2 Important Notes

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- for the design, construction, maintenance or operation of nuclear facilities;
- in air traffic control systems, air traffic or air traffic communication systems;
- in life support systems;
- in systems in which failures in the software could lead to personal injury or injuries leading to death.

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1.4.4 Warranty

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1.4.5 Export Regulations

The delivered product (including the technical data) is subject to export or import laws as well as the associated regulations of different counters, in particular those of Germany and the USA. The software may not be exported to countries where this is prohibited by the United States Export Administration Act and its additional provisions. You are obligated to comply with the regulations at your personal responsibility. We wish to inform you that you may require permission from state authorities to export, re-export or import the product.

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EtherCAT® is a registered trademark and a patented technology of Beckhoff Automation GmbH, Verl, Bundesrepublik Deutschland, formerly Elektro Beckhoff GmbH.

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2 Safety

2.1 General Note

The user manual, the accompanying texts and the documentation are written for the use of the products by educated personnel. When using the products, all safety instructions, safety messages and all valid legal regulations have to be obeyed. Technical knowledge is presumed. The user has to assure that all legal regulations are obeyed.

2.2 Intended Use

In this manual described devices:

- NB 100-RE-CO
- NB 100-RE-DP
- NB 100-RE-DN
- NB 100-RS-CO
- NB 100-RS-DP
- NB 100-RS-DN

are devices for communication and connect two communication networks. The NB 100 devices work as gateways between these two networks.

The NB 100 devices are made of a compact housing with IP 67 conformity and are designed for the mounting on a metallic underground.

2.3 Personnel Qualification

The netBRICK NB 100 Gateway must only be installed, configured and removed by qualified personnel. Job-specific technical skills for people professionally working with electricity must be present concerning the following topics:

- Safety and health at work
- Mounting and attaching of electrical equipment
- Measurement and Analysis of electrical functions and systems
- Evaluation of the safety of electrical systems and equipment
- Installing and configuring IT.

2.4 References Safety

[1] ANSI Z535.6-2006 American National Standard for Product Safety Information in Product Manuals, Instructions, and Other Collateral Materials

[2] EN 61340-5-1 and EN 61340-5-2 as well as IEC 61340-5-1 and IEC 61340-5-2

[3] UL-Report/File E326833 (Project 10CA56304, July 22, 2011)

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2.5 Safety Instructions to avoid Personal Injury

To ensure your own personal safety and to avoid personal injury, you necessarily must read, understand and follow the following safety instructions and all safety messages in this manual about danger causing personal injury, before you install and operate your netBRICK NB 100 device.

2.5.1 Use in Hazardous Locations only in Scope of the UL Standards

Important! Outside the scope of the UL standards you are allowed to use the netBRICK NB 100 device in **non-hazardous locations** only!

You are allowed to use the netBRICK NB 100 device in hazardous locations with potentially explosive atmosphere only in scope of the UL Standards and if the conditions given in the **UL-Report/File E326833** (Project 10CA56304, July 22, 2011) are adhered.

According to UL Report/File E326833 the netBRICK NB 100 device is suitable for use in **NEC500 Class I, Division 2, Groups A, B, C, and D** OR **non-hazardous locations** only. The diagnostic interface DIAG (USB connector located in the diagnostic area) of the netBRICK NB 100 device is not suitable for the use in hazardous locations with potentially explosive atmosphere.

When using the device in hazardous locations with potentially explosive atmosphere according to UL you must observe the following safety instructions.

- Do not connect or disconnect the netBRICK NB 100 device unless power has been removed or the area is known to be non-hazardous.
- Substitution of components may impair suitability for NEC500 Class I, Division 2, Groups A, B, C, and D.
- Do not use the diagnostic interface DIAG (USB connector) of the netBRICK NB 100 device in hazardous locations. Use the diagnostic interface DIAG only, if power has been removed or the area is known to be non-hazardous.
- Use only a power supply specified according to the UL standard.

2.5.2 Danger of unsafe System Operation

To prevent harm of persons, do not remove this device under runtime conditions before you can not guarantee further a safe and secure operation of the plant.

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2.6 Safety Instructions to avoid Property Damage

To avoid property damage respectively device destruction of the netBRICK NB 100 device, you necessarily must read, understand and follow the following safety instructions and all safety messages in this manual about danger causing property damage, before you install and operate your netBRICK NB 100 device.

2.6.1 Device Destruction by exceeding allowed Supply Voltage

Adhere for all netBRICK NB 100 device described in this manual the instruction hereafter:

The netBRICK NB 100 may only be operated with the specified supply voltage. Make sure that the limits of the allowed range for the supply voltage are not exceeded. A supply voltage above the upper limit can cause severe damage to the netBRICK NB 100! A supply voltage below the lower limit can cause malfunction in the netBRICK NB 100. The allowed range for the supply voltage is defined by the tolerances specified in this manual.

The data on the mandatory supply voltage for the netBRICK NB 100 device you find in the section *System Requirements* on page 27. There the required and permitted supply voltage for the netBRICK NB 100 device is provided inclusively the permitted tolerance range.

2.6.2 Electrostatically sensitive Devices

This equipment is sensitive to electrostatic discharge, which cause internal damage and affect normal operation. Befor you open the diagnostic interface DIAG (USB connector) of the netBRICK NB 100 device follow the guidelines:

- Touch a grounded object to discharge potential static.
- Wear an approved grounding wriststrap.
- Do not touch connectors or pins on the netBRICK NB 100 device.
- If available, use a static-safe workstation.
- When not in use, store the equipment in appropriate static-safe packaging.

Reference Safety [S2]

2.6.3 Danger of unsafe System Operation

To prevent property damage, do not remove this device under runtime conditions before you can not guarantee further a safe and secure operation of the plant.

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2.7 Labeling of Safety Messages

- The **Section Safety Messages** at the beginning of a chapter are pinpointed particularly. They are highlighted with a specific safety symbol and a signal word according to the degree of endangerment. Inside the safety message the danger is exactly named.
- The **Integrated Safety Messages** within a instruction description are highlighted with a signal word according to the degree of endangerment and possibly by an principle symbol. Inside the safety message the danger is exactly named.

Safety Symbol	Safety Symbol (USA)	Sort of Warning or Principle
		Warning of Personal Injury and Property Damage Message **USA:** Warning of Personal Injury As in the scope of the ANSI Z535 Standard (for USA) instructions to a property damage message may not contain a warning triangle, this property damage messages are listed separatly for the USA.
		Warning of Danger by Explosion Hazard
		Warning of Damages by Electrostatic Discharge

Table 17: Safety Symbols and Sort of Warning or Principle

Signal Word	Meaning	Meaning (USA)
	Indicates a possible hazard with medium risk, which will have as consequence death or (grievous) bodily harm if it isn't avoided.	Indicates a Hazardous Situation Which, if not Avoided, could Result in Death or Serious Injury.
	Indicates a minor hazard with medium risk, which could have as consequence simple battery if it isn't avoided.	Indicates a Hazardous Situation Which, if not Avoided, may Result in Minor or Moderate Injury.
	Indicates a Property Damage Message.	Indicates a Property Damage Message.
Note	Indicates an important note in the manual.	Indicates an Important Note in the Manual.

Table 18: Signal Words

In this document all Safety Instructions and Safety Messages are designed according both to the international used safety conventions as well as to the ANSI Z535 standard, refer to reference safety [S1].

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3 Description and Requirements

3.1 Device Description

The netBRICK NB100 devices described in this manual are communication devices that are connecting two networks to each other. The NB 100 devices are operating as gateway between both networks.

The netBRICK 100 is a device with two interface ports. Its principle functionality shows *Figure 1*. The function of the device is determined by the loaded firmware and the loaded configuration.

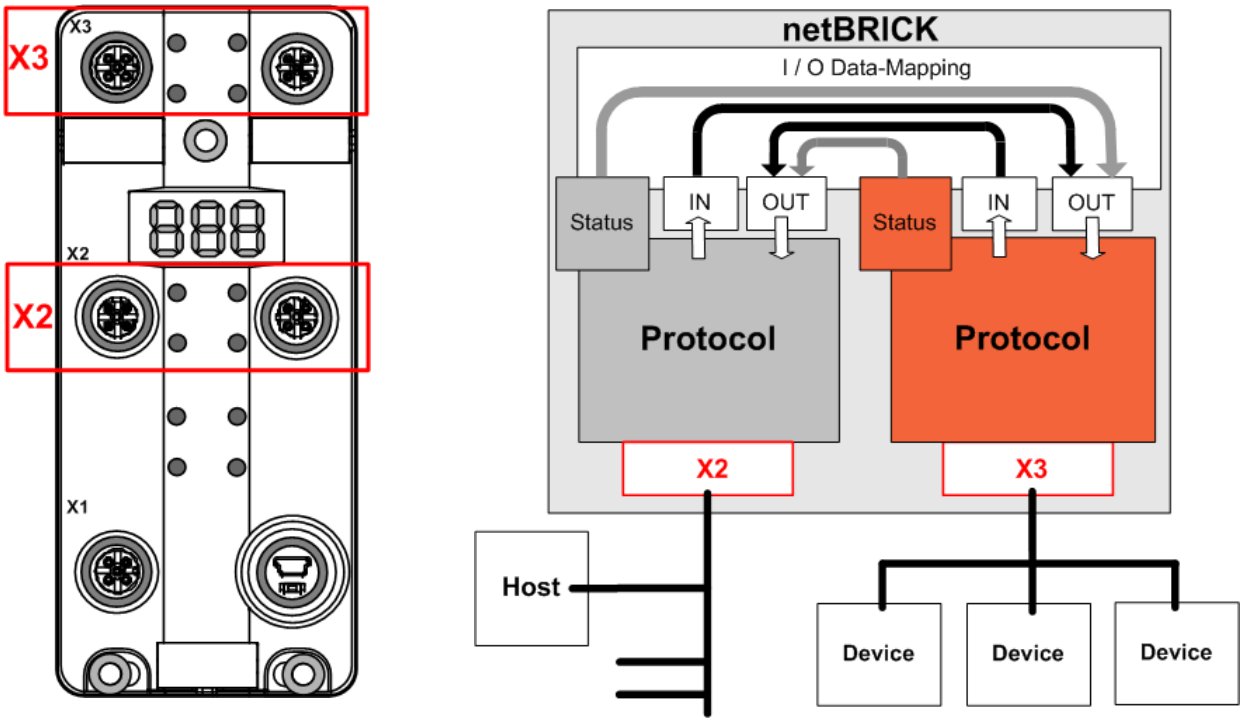

Figure 1: Function netBRICK

Basically it is possible to connect either to port X2 or X3 to a host or to field devices.

The device is configured via the USB interface (behind the covering cap) by a PC and the software SYCON.net. Online diagnostics is possible via the same interface.

The installation and operation of the configuration tool SYCON.net is described in the documentation *Configuration of Gateway and Proxy Devices OI xx EN.pdf* and located in the documents folder of the DVD included in the delivery.

The firmware buffers the cyclic send and receive data of the port X2 protocol and the X3 protocol internally. The configuration tool enables the flexible mapping of the receive data of protocol X2 to send data of the protocol X3 and vice versa.

Status information of the protocol at port X2 can be mapped into the send data of the protocol at port X3 and vice versa.

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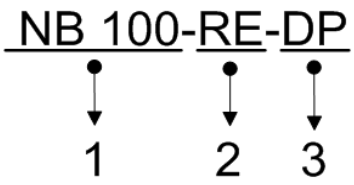
The firmware of netBRICK NB100 as gateway does not support acyclic communications or special services of the supported protocols.

The devices have a plastic housing and moulded electronics and complies to the IP67 level of protection. The device is protected against dust ingress and water in harmful quantity.

All connections are realized as M12 connectors (in accordance with DIN EN 61076-2-101/ IEC 61076-2-101) with different codings.

3.2 Device Names

The descriptive device name of netBRICK devices consists of the following parts



1. Device type netBRICK NB100
2. Network at X2 (middle part of the device). The example shows RE for Real-Time Ethernet.
3. Network at X3 (upper part of the device). The example shows DP for PROFIBUS DP.

The following interfaces are currently supported at the primary network X2:

Code	Interface
RE	Real-Time Ethernet (2* RJ45)
RS	Serial Interfaces: RS-232, RS-422, RS-485 (2 x M12, B coded, female connector)

Table 19: Network on Port X2 (Primary Network)

The following interfaces are currently supported at the secondary network X3:

Code	Interface
DP	PROFIBUS DP (M12, B coded, 1 x female connector, 1 x male connector)
CO	CANopen (M12, A coded, 1 x female connector, 1 x male connector)
DN	DeviceNet (M12, A coded, 1 x female connector, 1 x male connector)

Table 20: Network on Port X3 (Secondary Network)

Accordingly to the protocol at port X3 the LED ⑳ (in *Figure 5: LEDs and Control Elements* on page 31) is labeled.

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3.3 Protocol Conversions

Information about the configuration of the protocol conversion of the device is in the operating instruction manual *Configuration of Gateway and Proxy Devices OI xx EN.pdf* on the DVD in the directory `Documentation`.

3.3.1 Protocol Conversion - Ethernet to Fieldbus

The netBRICK NB 100 connects to Ethernet on port X2 and connects to fieldbus on port X3.

The following devices support this:

Device Name	Ethernet Protocol (X2)	Fieldbus Protocol (X3)	Firmware File	Firmware Version
NB 100-RE-CO	EtherCAT Master	CANopen Slave	NBECMCOS.NXF	1.5.x.x
	EtherCAT Slave	CANopen Master	NBECSCOM.NXF	
	EtherCAT Slave	CANopen Slave	NBECSCOS.NXF	
	EtherNet/IP Scanner / Master	CANopen Slave	NBEIMCOS.NXF	
	EtherNet/IP Adapter / Slave	CANopen Master	NBEISCOM.NXF	
	EtherNet/IP Adapter / Slave	CANopen Slave	NBEISCOS.NXF	
	Open Modbus/TCP	CANopen Master	NBOMBCOM.NXF	
	Open Modbus/TCP	CANopen Slave	NBOMBCOS.NXF	
	POWERLINK Slave	CANopen Master	NBPNSCOM.NXF	
	POWERLINK Slave	CANopen Slave	NBPNSCOS.NXF	
	PROFINET IO Controller	CANopen Slave	NBPNMCOS.NXF	
	PROFINET IO Device	CANopen Master	NBPNSCOM.NXF	
	PROFINET IO Device	CANopen Slave	NBPNSCOS.NXF	
	sercos Master	CANopen Slave	NBS3MCOS.NXF	
	sercos Slave	CANopen Master	NBS3SCOM.NXF	
	sercos Slave	CANopen Slave	NBS3SCOS.NXF	

Table 21: Protocol Conversion - Ethernet to Fieldbus (Part 1)

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Device Name	Ethernet Protocol (X2)	Fieldbus Protocol (X3)	Firmware File	Firmware Version
NB 100-RE-DN	EtherCAT Master	DeviceNet Slave	NBECMDNS.NXF	1.5.x.x
	EtherCAT Slave	DeviceNet Master	NBECSDNM.NXF	
	EtherCAT Slave	DeviceNet Slave	NBECSDNS.NXF	
	EtherNet/IP Scanner / Master	DeviceNet Slave	NBEIMDNS.NXF	
	EtherNet/IP Adapter / Slave	DeviceNet Master	NBEISDNM.NXF	
	EtherNet/IP Adapter / Slave	DeviceNet Slave	NBEISDNS.NXF	
	Open Modbus/TCP	DeviceNet Master	NBOMBDNM.NXF	
	Open Modbus/TCP	DeviceNet Slave	NBOMBDNS.NXF	
	POWERLINK Slave	DeviceNet Master	NBPNSDNM.NXF	
	POWERLINK Slave	DeviceNet Slave	NBPNSDNS.NXF	
	PROFINET IO Controller	DeviceNet Slave	NBPNMDNS.NXF	
	PROFINET IO Device	DeviceNet Master	NBPNSDNM.NXF	
	PROFINET IO Device	DeviceNet Slave	NBPNSDNS.NXF	
	sercos Master	DeviceNet Slave	NBS3MDNS.NXF	
	sercos Slave	DeviceNet Master	NBS3SDNM.NXF	
	sercos Slave	DeviceNet Slave	NBS3SDNS.NXF	
NB 100-RE-DP	EtherCAT Master	PROFIBUS DP Slave	NBECMDPS.NXF	
	EtherCAT Slave	PROFIBUS DP Master	NBECSDPM.NXF	
	EtherCAT Slave	PROFIBUS DP Slave	NBECSDPS.NXF	
	EtherNet/IP Scanner / Master	PROFIBUS DP Slave	NBEIMDPS.NXF	
	EtherNet/IP Adapter / Slave	PROFIBUS DP Master	NBEISDPM.NXF	
	EtherNet/IP Adapter / Slave	PROFIBUS DP Slave	NBEISDPS.NXF	
	Open Modbus/TCP	PROFIBUS DP Master	NBOMBDPM.NXF	
	Open Modbus/TCP	PROFIBUS DP Slave	NBOMBDPS.NXF	
	POWERLINK Slave	PROFIBUS DP Master	NBPNSDPM.NXF	
	POWERLINK Slave	PROFIBUS DP Slave	NBPNSDPS.NXF	
	PROFINET IO Controller	PROFIBUS DP Slave	NBPNMDPS.NXF	
	PROFINET IO Device	PROFIBUS DP Master	NBPNSDPM.NXF	
	PROFINET IO Device	PROFIBUS DP Slave	NBPNSDPS.NXF	
	sercos Master	PROFIBUS DP Slave	NBS3MDPS.NXF	
	sercos Slave	PROFIBUS DP Master	NBS3SDPM.NXF	
	sercos Slave	PROFIBUS DP Slave	NBS3SDPS.NXF	

Table 22: Protocol Conversion - Ethernet to Fieldbus (Part 2)

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3.3.2 Protocol Conversion - Serial Protocols to Fieldbus

The netBRICK NB 100 connects to serial interfaces (RS) on port X2 and connects to fieldbus on port X3.

The following devices support this:

Device Name	Serial Protocol (X2)	Fieldbus Protocol (X3)	Firmware File	Firmware Version
NB 100-RS-CO	ASCII	CANopen Slave	NBASCCOS.NXF	1.5.x.x
	ASCII	CANopen Master	NBASCCOM.NXF	
	Modbus RTU Master/Slave	CANopen Slave	NBMBRCOS.NXF	
	Modbus RTU Master/Slave	CANopen Master	NBMBRCOM.NXF	
	3964R	CANopen Slave	NBNVRCOS.NFX	
	3964R	CANopen Master	NBNVRCOM.NFX	
NB 100-RS-DN	ASCII	DeviceNet Slave	NBASCDNS.NXF	
	ASCII	DeviceNet Master	NBASCDNM.NXF	
	Modbus RTU Master/Slave	DeviceNet Slave	NBMBRDNS.NXF	
	Modbus RTU Master/Slave	DeviceNet Master	NBMBRDNM.NXF	
	3964R	DeviceNet Slave	NBNVRDNS.NFX	
	3964R	DeviceNet Master	NBNVRDNM.NFX	
NB 100-RS-DP	ASCII	PROFIBUS DP Slave	NBASCDPS.NXF	
	ASCII	PROFIBUS DP Master	NBASCDPM.NXF	
	Modbus RTU Master/Slave	PROFIBUS DP Slave	NBMBRDPS.NXF	
	Modbus RTU Master/Slave	PROFIBUS DP Master	NBMBRDPM.NXF	
	3964R	PROFIBUS DP Slave	NBNVRDPS.NFX	
	3964R	PROFIBUS DP Master	NBNVRDPM.NFX	

Table 23: Protocol Conversion – Serial Protocols to Fieldbus

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3.4 System Requirements

The netBRICK device has to be mounted on a flat surface. An optimal material is a metal plate (which is connected to potential equalization of the plant) where the device can be screw mounted. In case the surface is not metallic at least the two bottom screw connections have to be extensively connected to potential equalization of the installation site.

A suitable power supply is required. The voltage to be applied must be in the allowed range 24 V ± 6 V DC. The power supply must be able to deliver at least a current of 130 mA at 24 V.

Power is supplied via connector X1.

NOTICE

Device Destruction!

- The voltage must not exceed 30 V significantly, otherwise the device may be destroyed or damaged.

In order to avoid damage caused by overheating or freezing, it is necessary that the temperature of the device does not exceed the limits of the allowed temperature range.

The following preconditions must additionally be met in order to operate the Gateway device successfully:

1. The Gateway device must have been loaded with the correctly suiting firmware.
2. The Gateway device must have been configured correctly using the configuration and diagnostic software SYCON.net.

3.5 Configuration Requirements

The configuration software SYCON.net must be installed on a PC to configure the netBRICK 100.

The requirements for the PC are:

- PC with 1 GHz processor or higher
- Windows® XP SP3, Windows® Vista (32 bit) SP2, Windows® 7 (32 bit) or Windows® 7 (64 bit)
- Administrator rights
- Internet Explorer 5.5 or higher
- Free disk space: min. 400 MByte
- DVD ROM drive
- RAM: min. 512 MByte, recommended 1024 MByte
- Graphic resolution: min. 1024 x 768 pixel
- Keyboard and Mouse
- USB

Note: If the project file is saved and opened again or it is used on another PC, the system requirements need to match. Particularly the DTMs need to be installed on the used PC.

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3.6 Licenses

If the netBRICK NB 100 device is used in conjunction with a firmware that has master functionality (except Modbus RTU or Open Modbus/TCP) a master license in the netBRICK device must be present.

If the device has a master license can be read out with the software SYCON.net.

Note: A firmware has to be loaded into the device to read out, if the device has a master license. The base firmware is not sufficient for this purpose. How to load a firmware into the device and how to read out if the device has a master license is described in the operating instruction manual *Configuration of Gateway and Proxy Devices OI xx EN.pdf*.

The master license can be ordered later with SYCON.net and transferred with SYCON.net into the device. The master license can be ordered with at Hilscher ‘NXLIC-MASTER’ and has part number 8211.000.

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4 Device Drawings and Connections

4.1 Dimensioned Drawing

All dimensions are in mm.

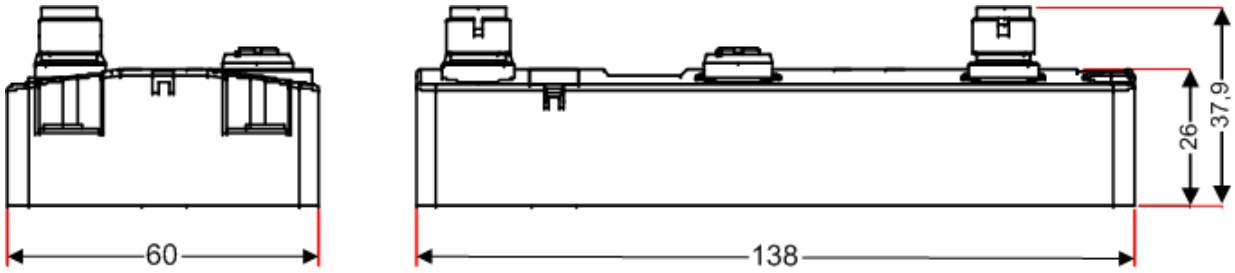

Figure 2: Dimensioned Drawing

Please take care of the device's headroom. There is enough space necessary to allow the connection of the connectors and wires since they are all tending upwards.

4.2 Drilling Template

The illustrated drilling template you can get in an actual size for printing on the delivered DVD in the folder „Documentation > netBRICK". The TIF-File is named „drilling template.tif".

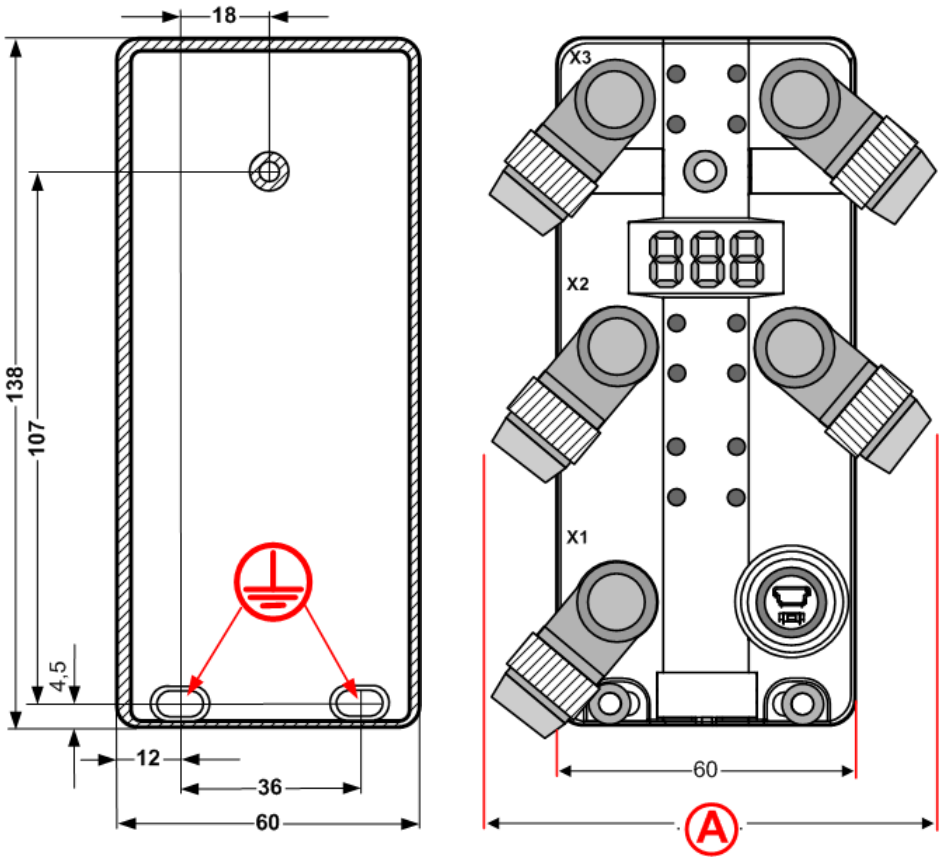

Figure 3: Drilling Template

Please take into account that the device's distance Ⓐ is depending on the used connector and cable type.

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4.3 Device Label

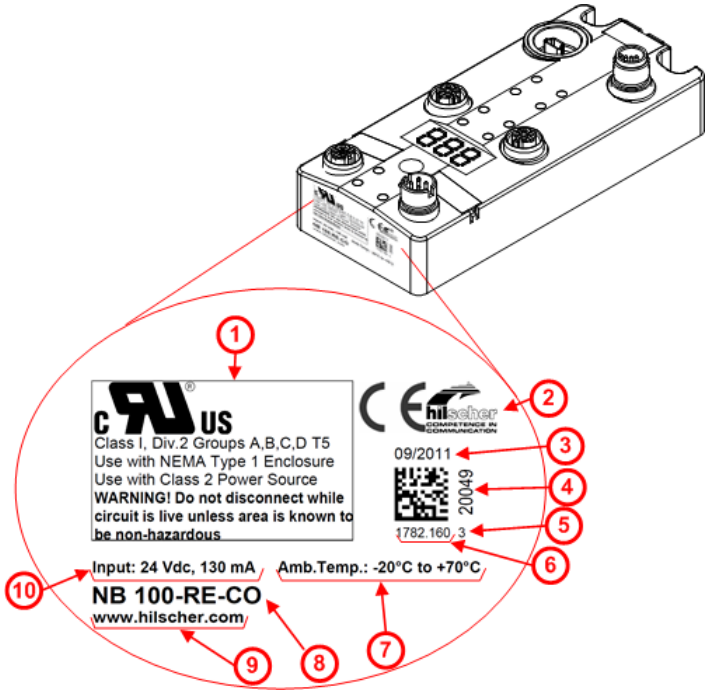

Figure 4: Device Label

No.	Meaning
1	UL safety instructions for usage in hazardous area.
2	Logo.
3	Production month/year
4	Serial number
5	Hardware revision.
6	Hilscher part number.
7	Ambient temperatur permitted for the device.
8	Device name, see also section 3.2 on page 23.
9	Hilscher hompage.
10	Supply voltage and current consumption of the device.

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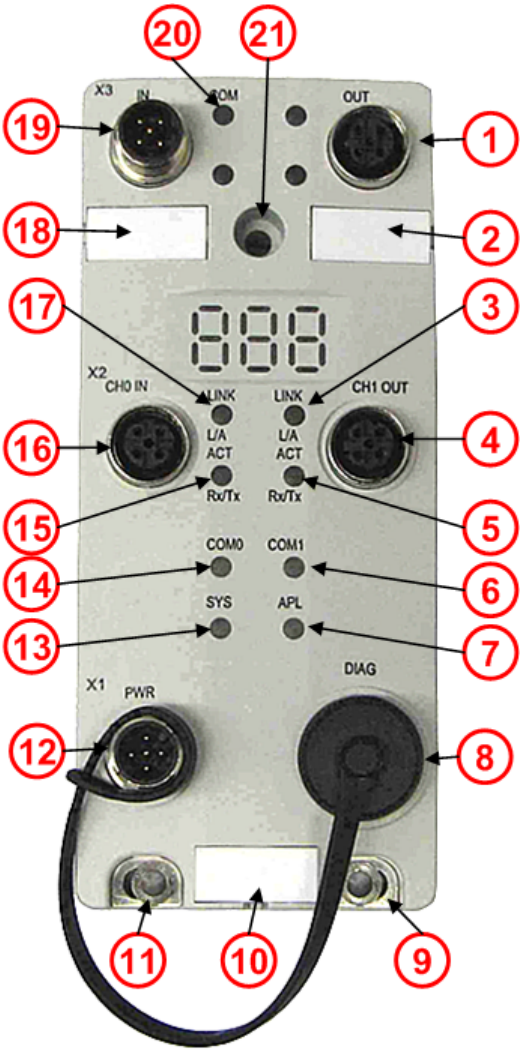
4.4 Positions of LEDs and Control Elements

4.4.1 Elements of the netBRICK NB 100-RE-xx Device



No.	Description
1	Fieldbus connector OUT (female)
2	User label
3	LINK LED / L/A LED Ethernet connection OUT
4	Ethernet connector CH1 OUT
5	ACT LED / Rx/Tx LED Ethernet connection OUT
6	COM1 LED, protocol dependent
7	APL LED
8	Covering cap for the diagnostic port. Underneath the cover you will find the USB service port and a push button used during manufacturing
9	Screw hole for connection to potential equalization
10	User label
11	Screw hole for connection to potential equalization
12	Connector PWR for power supply
13	SYS LED
14	COM0 LED, protocol dependent
15	ACT LED / Rx/Tx LED Ethernet connection IN
16	Ethernet connector CH0 IN
17	LINK LED / L/A LED Ethernet connection IN
18	User label
19	Fieldbus connector IN (male)
20	LED for fieldbus protocols. Labeling and function is protocol dependent
21	Screw hole with no connection to potential equalization

Figure 5: LEDs and Control Elements NB 100-RE-XX

The labeling of the LED 20 is device dependent.

Label of the LED 20	Protocol	Device Type
CAN	CANopen	NB 100-RE-CO
MNS	DeviceNet	NB 100-RE-DN
COM	PROFIBUS	NB 100-RE-DP

Table 24: LED (20) – Labeling

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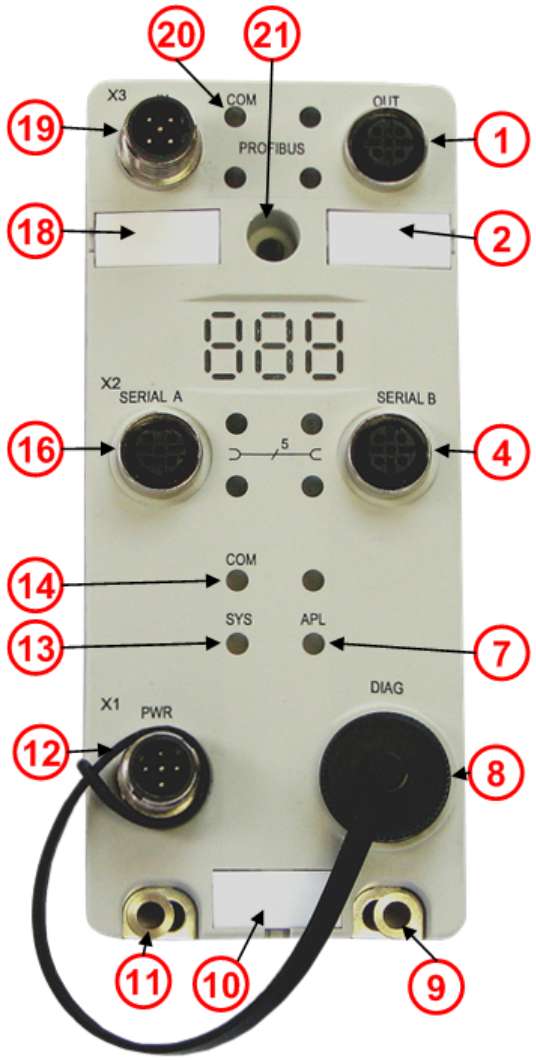
4.4.2 Elements of the netBRICK NB 100-RS-xx Device



No.	Description
1	Fieldbus connector OUT (female)
2	User label
4	Serial RS interface, parallel with 16
7	APL LED
8	Covering cap for the diagnostic port. Underneath the cover you will find the USB service port and a push button used during manufacturing
9	Screw hole for connection to potential equalization
10	User label
11	Screw hole for connection to potential equalization
12	Connector PWR for power supply
13	SYS LED
14	COM LED, protocol dependent
16	Serial RS interface, parallel with 4
18	User label
19	Fieldbus connector IN (male)
20	LED for fieldbus protocols. Labeling and function is protocol dependent
21	Screw hole with no connection to potential equalization

Figure 6: LEDs and Control Elements NB 100-RS-xx

The labeling of the LED 20 is device dependent.

Label of the LED 20	Protocol	Device Type
CAN	CANopen	NB 100-RS-CO
MNS	DeviceNet	NB 100-RS-DN
COM	PROFIBUS	NB 100-RS-DP

Table 25: LED (20) – Labeling

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4.5 Connections

4.5.1 X1 Power Supply PWR

The power supply of netBRICK NB 100 devices has to be connected to the connector X1 (12), which is of type M12 male A coded. The voltage level need to be between 18 V and 30 V DC.

Power Supply Line Pin Assignment

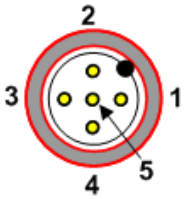
Power supply line	Pin	Signal	Description
 M12 connector A coded	1	24 V	+24 V supply voltage
	2	-	not used
	3	0 V / GND	Ground of supply voltage
	4	-	not used
	5	-	not used
		PE	Metal screw connection

Table 26: X1 Power Supply Line Pin Assignment

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4.5.2 X2 Front Connection

4.5.2.1 X2 Ethernet Connection for NB 100-RE-xx Devices

For the Ethernet connection you have to use M12 male connectors with AWG22 or AWG 26 cable.

Note: The device supports auto crossover functionality, which enables twisting of RX and TX transmission lines. The following picture illustrates the M12 standard pin layout.

Connector Ethernet IN (16) to the left hand side of the device.

Ethernet at M12 Pin Assignment

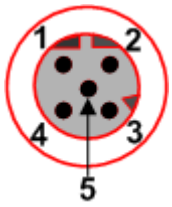
Ethernet	Pin	Signal	Description
 M12 female connector, D coded	1	Ethernet Tx +	Transmit data +
	2	Ethernet Rx +	Receive data +
	3	Ethernet Tx -	Transmit data –
	4	Ethernet Rx -	Receive data –
	5	-	not used
		PE	Metal screw connection

Table 27: Ethernet Pin Assignment

Connector Ethernet OUT (4) to the right hand side of the device.

Ethernet at M12 Pin Assignment

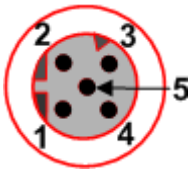
Ethernet	Pin	Signal	Description
 M12 female connector, D coded	1	Ethernet Tx +	Transmit data +
	2	Ethernet Rx +	Receive data +
	3	Ethernet Tx -	Transmit data –
	4	Ethernet Rx -	Receive data –
	5	-	not used
		PE	Metal screw connection

Table 28: Ethernet Pin Assignment

Both female connectors are angled by 90° to each other. This enables the use of angled connectors. The cable can be conducted at a relative angle of 45° compared to the device in this case.

Important: Please note for the use of hubs and switches the wiring instructions in section *Ethernet* on page 109.

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4.5.2.2 X2 Serial Connection for NB 100-RS-xx Devices

Note: The connections SERIAL A and SERIAL B are galvanically connected 1:1 in parallel.

Both connectors are angled by 90° to each other. Both connectors are B coded.

RS-232 M12 Pin Assignment

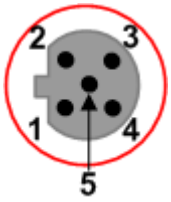
RS-232	Pin	Signal	Description
 M12 female connector, B coded	1	CTS	Clear To Send
	2	RxD	Receive data
	3	TxD	Transmit data
	4	RTS	Request To Send
	5	ISO GND	Data ground
		PE	Metal screw connection

Table 29: M12 RS-232 Pin Assignment

RS-422 M12 Pinbelegung

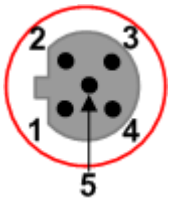
RS-422	Pin	Signal	Description
 M12 female connector, B coded	1	Tx +	Transmit data positive
	2	Rx -	Receive data negative
	3	Tx -	Transmit data negative
	4	Rx +	Receive data positive
	5	ISO GND	Isolated ground
		PE	Metal screw connection

Table 30: RS-422 M12 Pin Assignment

RS-485 M12 Pinbelegung

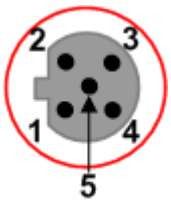
RS-485	Pin	Signal	Description
 M12 female connector, B coded	1	TX_P	Reserved. Do not connect!
	2	Rx/Tx -	Receive data / Transmit data negative, A-Line
	3	TX_N	Reserved. Do not connect!
	4	Rx/Tx +	Receive data / Transmit data positive, B-Line
	5	ISO GND	Data ground
		PE	Metal screw connection

Table 31: RS-485 M12 Pin Assignment

Please note the wiring instructions for *RS-232* on page 110, for *RS-422* on page 111 and for *RS-485* on page 113.

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4.5.3 X3 Fieldbus Connection

4.5.3.1 X3 PROFIBUS Interface

The PROFIBUS interface X3 is a RS-485 interface according to PROFIBUS standard EN 50170.

Connector IN (19), M12 male connector, B coded.

PROFIBUS M12 RS-485 Pin Assignment

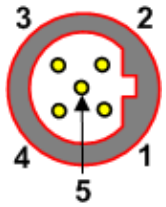
PROFIBUS	Pin	Signal	Description
 M12 connector, B coded	1	VP	+5 V Power supply for termination max. 100 mA
	2	Rx/Tx -	Receive data / Transmit data negative, A-Line
	3	ISO GND	Data ground
	4	Rx/Tx +	Receive data / Transmit data positive, B-Line
	5	PE	Shield
		PE	Metal screw connection

Table 32: PROFIBUS M12 RS-485 Pin Assignment

Connector OUT (1), M12 male connector, B coded.

PROFIBUS M12 RS-485 Pin Assignment

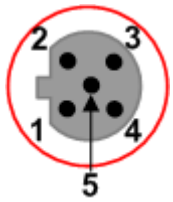
PROFIBUS	Pin	Signal	Description
 M12 female connector, B coded	1	VP	+5 V Power supply for termination max. 100 mA
	2	Rx/Tx -	Receive data / Transmit data negative, A-Line
	3	ISO GND	Data ground
	4	Rx/Tx +	Receive data / Transmit data positive, B-Line
	5	PE	Shield
		PE	Metal screw connection

Table 33: PROFIBUS M12 Pin Assignment

The ports are oriented in a way that angled plugs will angle at 45 degrees away from the device and are pointing downwards.

The pins of the connector IN and OUT are connected galvanically. The power supply VP can be loaded in sum max. with 100 mA.

Please note the wiring instructions in section *PROFIBUS* on page 104.

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4.5.3.2 X3 CANopen Interface

The CANopen interface X3 is according to ISO 11898.

Connector IN (19), M12 male connector, A coded.

CANopen M12 Pin Assignment

CANopen	Pin	Signal	Description
M12 connector A coded	1	PE	Shield
	2	V+	+24 V CANopen-Power supply
	3	ISO GND	CAN ground, 15 nF against PE
	4	CAN H	CAN High-Signal
	5	CAN L	CAN Low-Signal
		PE	Metal screw connection

Table 34: CANopen M12 Pin Assignment

Connector OUT (1), M12 female connector, A coded.

CANopen M12 Pin Assignment

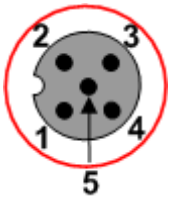
CANopen	Pin	Signal	Description
 M12 female connector A coded	1	PE	Shield
	2	CAN_V+	+24 V CANopen Power supply
	3	ISO GND	CAN ground, 15 nF against PE
	4	CAN H	CAN High-Signal
	5	CAN L	CAN Low-Signal
		PE	Metal screw connection

Table 35: CANopen M12 Pin Assignment

The ports are oriented in a way that angled plugs will angle at 45 degrees away from the device and are pointing downwards.

The pins of the connector IN and OUT are connected galvanically.

Please note the wiring instructions in section *CANopen* on page 106.

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4.5.3.3 X3 DeviceNet Interface

The pinning of the DeviceNet interface X3 is according to the DeviceNet standard.

Important: According to the DeviceNet specification it is not allowed to lead the DeviceNet bus through the device! No interruption of the DeviceNet network must occur if a device is replaced! Therefore, **you must use one connection port only** (IN or OUT)!

The pins of the connector IN and OUT are connected galvanically.

Connector IN ⑲.

DeviceNet M12 Pin Assignment

DeviceNet	Pin	Signal	Description
M12 connector A coded	1	PE	Shield
	2	V+	+24 V DeviceNet- supply voltage
	3	ISO GND	DeviceNet common ground, 15 nF against PE
	4	CAN H	CAN High-Signal
	5	CAN L	CAN Low-Signal
		PE	Metal screw connection

Table 36: DeviceNet M12 Pin Assignment

Connector OUT ①.

DeviceNet M12 Pin Assignment

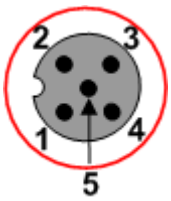
DeviceNet	Pin	Signal	Description
 M12 female connector A coded	1	PE	Shield
	2	V+	+24 V DeviceNet- supply voltage
	3	ISO GND	DeviceNet common ground , 15 nF against PE
	4	CAN H	CAN High-Signal
	5	CAN L	CAN Low-Signal
		PE	Metal screw connection

Table 37: DeviceNet M12 Pin Assignment

The ports are oriented in a way that angled plugs will angle at 45 degrees away from the device and are pointing downwards.

Please note the wiring instructions in section *DeviceNet* on page 107.

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4.5.4 Diagnostic Interface

4.5.4.1 Safety Messages on Personal Injury

Use in Hazardous Locations with Potentially Explosive Atmosphere only in Scope of the UL Standards

Important! Outside the scope of the UL standards you are allowed to use the netBRICK NB 100 device in **non-hazardous locations** only!

When using the device in hazardous locations with potentially explosive atmosphere according to UL (UL-Report/File E326833) you must observe the following safety messages.

WARNING

Explosion Hazard!

- Do not use the diagnostic interface DIAG (USB connector) of the net-BRICK NB 100 device in hazardous locations. Use the diagnostic interface DIAG only, if power has been removed or the area is known to be non-hazardous.

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4.5.4.2 Diagnostic Interface

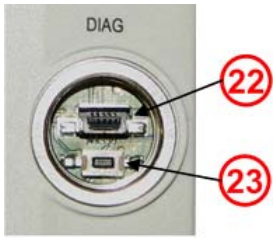
NOTICE

Electrostatically sensitive Devices

➢ To prevent damage to the netBRICK NB 100 device, make sure, that you are discharged when you open the diagnostic interface DIAG (USB connector) of the netBRICK NB 100 device.

Important: Connect the USB cable to the device after the device was powered. Otherwise this may cause malfunction.

Under the cover of the diagnostic interface (8) are two elements:



No	Description
22	USB (socket) for configuration and Diagnosis
23	Button for manufacturing test

Figure 7: Diagnostic Interface

The USB interface (22) is for configuration and diagnostic purpose using a PC with SYCON.net software.

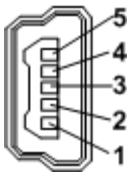
USB female connector	Pin	Signal	Description
	1	NC	Not connected
	2	D-	Data -
	3	D+	Data +
	4		Not to be occupied in the USB cable or the USB cable must be connected to the device after Power On.
	5	GND	Ground
	Shield	PE	Metal shell to PE

Table 38: Pin Assignment Mini-B USB Connector (5 pin)

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4.6 Schematic Diagram - Galvanic Isolation

The following schematic diagram illustrates the internal connection between the different connectors. This gives you the possibility to properly install the device in accordance with the potential equalization concept of your plant.

Note: The PE connection (potential equalization) of the device is done via the two bottom screw holes.

4.6.1 Galvanic Isolation NB 100-RE-DP Device

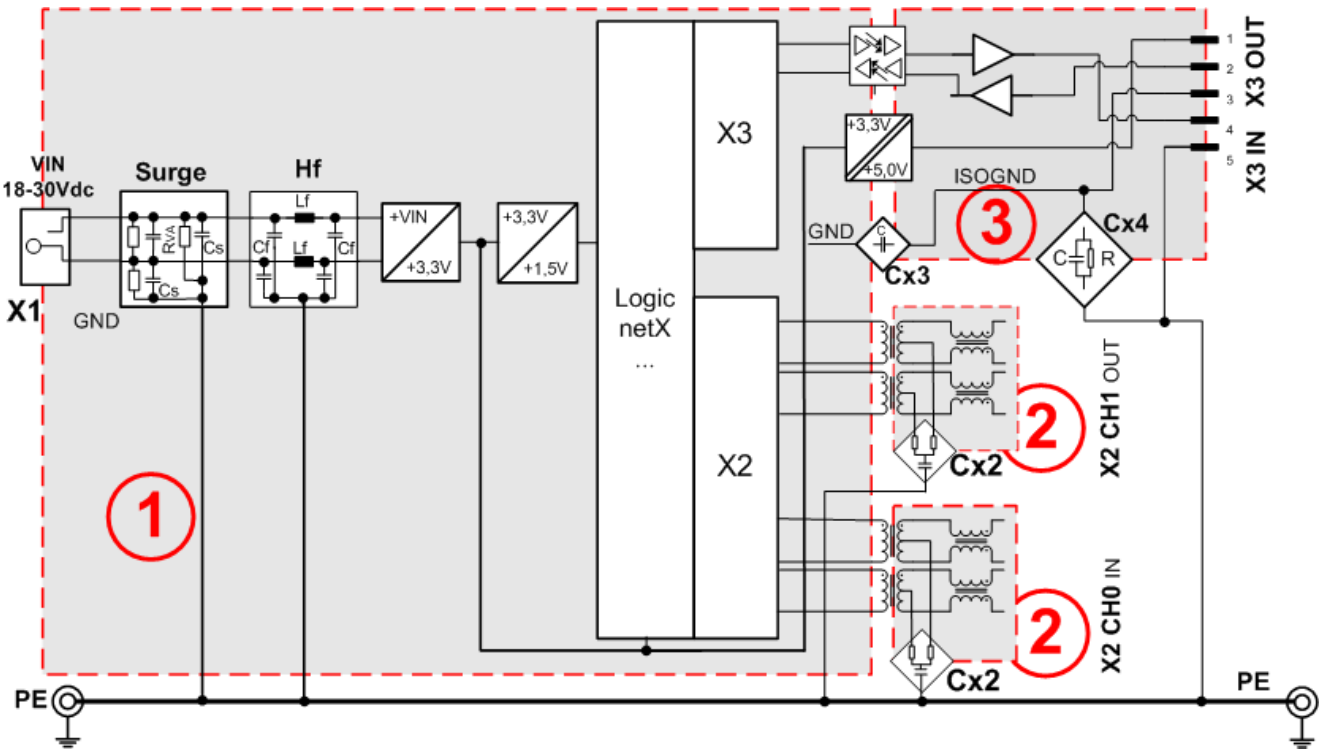

Figure 8: Galvanic Isolation NB 100 RE-DP Device

The device has three galvanically isolated areas

1. System area, galvanically coupled with the power supply connection X1
2. Ethernet connecting area, 2 * M12 D coded. Both Ethernet ports are galvanically isolated against each other.
3. Fieldbus connecting area, M12 male and female connector A or B coded. The pins are connected to each other internally.

The following table shows the characteristics of the galvanic isolation of the different areas and coupling against potential equalization.

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Area Connection	Protocol	Galvanic Isolation	Coupling	Coupling against PE Potential
X1 (1)	All devices	no	Surge	3 * 15 nF 500V 3 * RVA, voltage-dependent resistance, reversible UVA > 38V
			HF	4 * Cf = 100 nF, 2 * Lf = 100 µH
X2 (2)	Ethernet	yes	Cx2 (2)	each 2 * 75 Ω, 1 nF 1000 V
X3 (3)	All devices	yes	Cx3	1 nF 2000 V
	PROFIBUS DP		Cx4	1 MΩ // 2,2 nF 1000 V

Table 39: Coupling NB 100-RE-DP Device

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4.6.2 Galvanic Isolation NB 100-RE-DN/CO Device

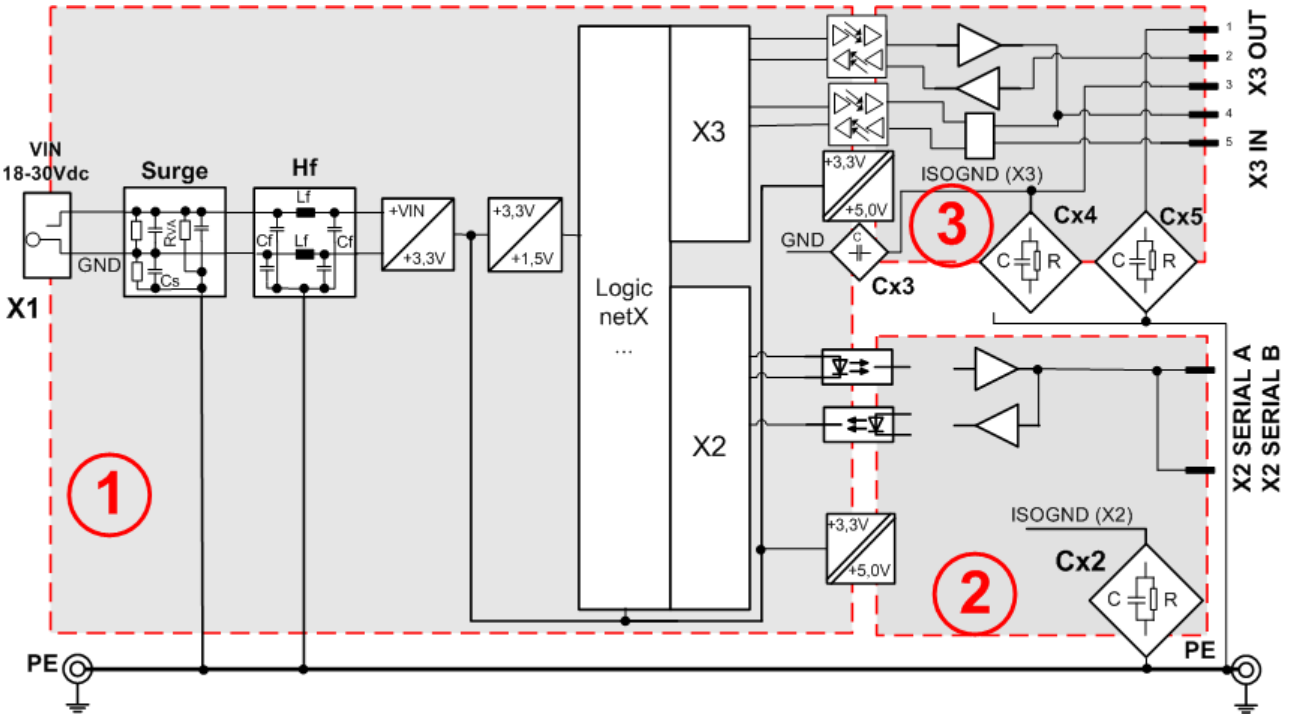

Figure 9: Galvanic Isolation NB 100-RE-DN/CO Device

The device has three galvanically isolated areas

1. System area, galvanically coupled with the power supply connection X1
2. Ethernet connecting area, 2 * M12 D coded. Both Ethernet ports are galvanically isolated against each other.
3. Fieldbus connecting area, M12 male and female connector A or B coded. The pins are connected to each other internally.

The following table shows the characteristics of the galvanic isolation of the different areas and coupling against potential equalization.

Area Connection	Protocol	Galvanic Isolation	Coupling	Coupling against PE Potential
X1 (1)	All devices	no	Surge	3 * 15 nF 500 V 3 * RVA, voltage-dependent resistance, reversible UVA > 38 V
			HF	4 * Cf = 100 nF, 2 * Lf = 100 µH
X2 (2)	Ethernet	yes	Cx2	Je 2 * 75 Ω, 1 nF 1000 V
X3 (3)	All devices	yes	Cx3	1 nF 2000 V
	CANopen		Cx4 + Cx5	Cx4 = (1 MΩ // 15 nF 1000 V); Cx5 = 0 Ω
	DeviceNet		Cx4 + Cx5	each 1 MΩ // 15 nF 1000 V

Table 40: Galvanic Isolation NB 100-RE-DN/CO Device

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4.6.3 Galvanic Isolation NB 100-RS-DP Device

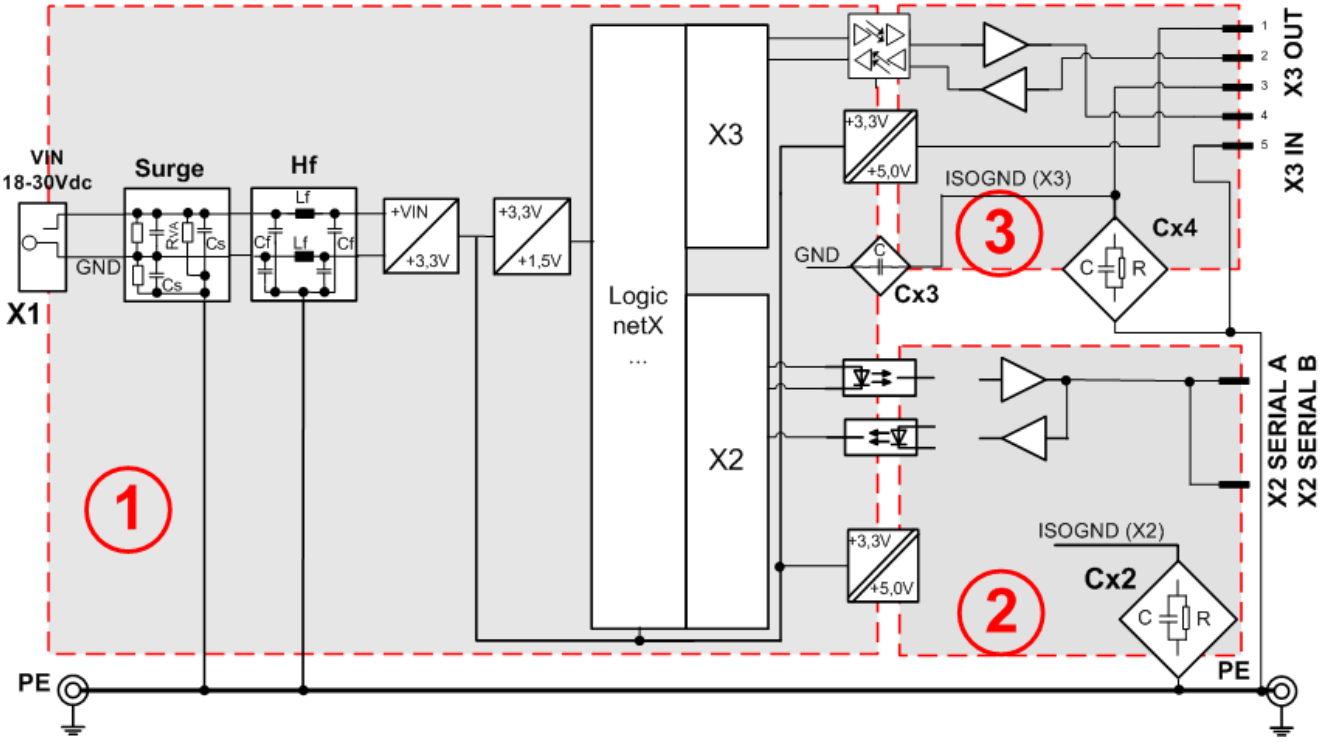

Figure 10: Galvanic Isolation NB 100-RS-DP Device

The device has three galvanically isolated areas

1. System area, galvanically coupled with the power supply connection X1
2. Serial connecting area, 2 * M12 B coded female connector. All pins are connected to each other internally.
3. Fieldbus connecting area, M12 male and female connector B coded. The pins are connected to each other internally.

The following table shows the characteristics of the galvanic isolation of the different areas and coupling against potential equalization.

Area Connection	Protocol	galv. Isolation	Coupling	Coupling against PE potential
X1 (1)	All devices	no	Surge	3 * 15 nF 500V 3 * RVA, voltage-dependent resistance, reversible UVA > 38 V
			HF	4 * Cf = 100 nF, 2 * Lf = 100 µH
X2 (2)	Serial	yes	Cx2	500 kΩ // 30 nF 1000 V
X3 (3)	PROFIBUS DP	yes	Cx3	1 nF 2000 V
			Cx4	1 MΩ // 2,2 nF 1000 V

Table 41: Galvanic Isolation NB 100-RS-DP Device

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4.6.4 Galvanic Isolation NB 100-RS-DN/CO Device

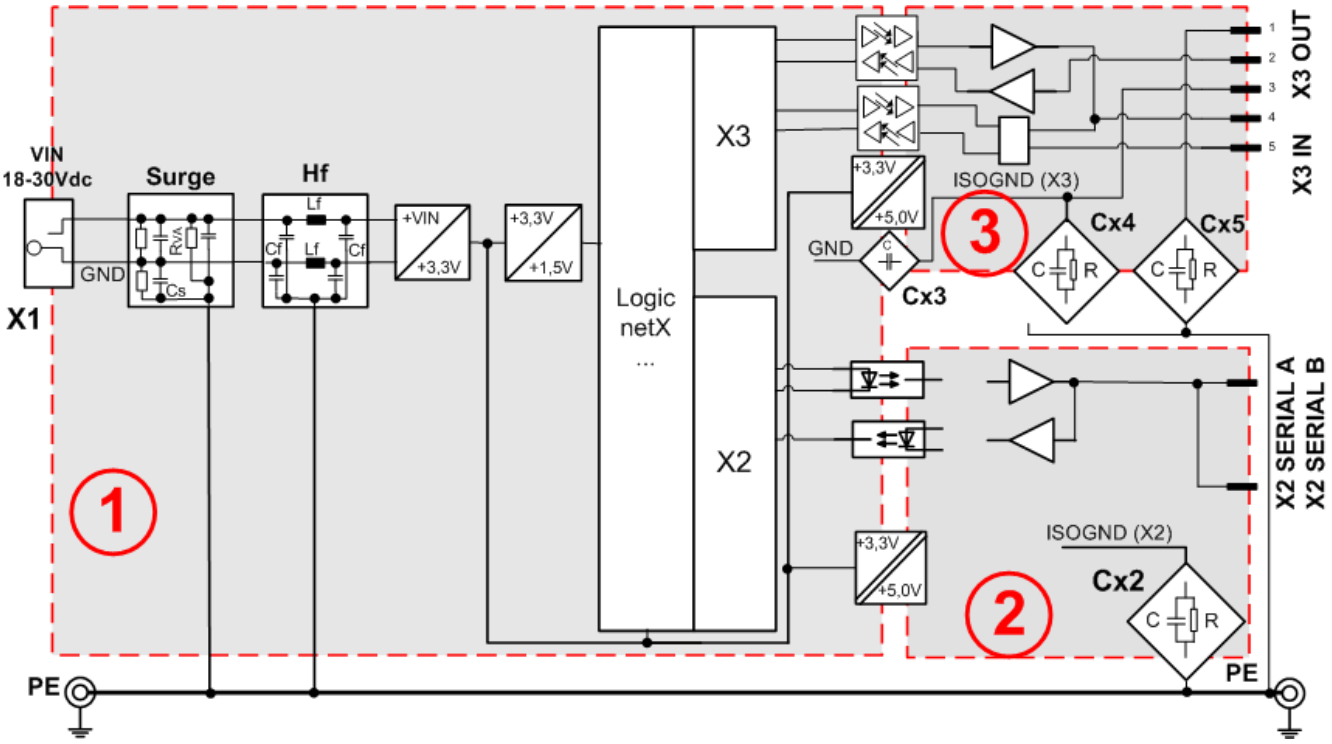

Figure 11: Galvanic Isolation NB 100-RS-DN/CO Device

The device has three galvanically isolated areas

(1) System area, galvanically coupled with the power supply connection X1

(2) Serial connecting area, 2 * M12 B coded female connector. All pins are connected to each other internally.

(3) Fieldbus connecting area, M12 male and female connector B coded. The pins are connected to each other internally.

The following table shows the characteristics of the galvanic isolation of the different areas and coupling against potential equalization.

Area Connec-tion	Protocol	Galvanic Isolation	Coupling	Coupling against PE Potential
X1 (1)	All devices	no	Surge	3 * 15 nF 500V 3 * RVA, voltage-dependent resis-tance, reversible UVA > 38 V
			HF	4 * Cf = 100 nF, 2 * Lf = 100 µH
X2 (2)	Serial	yes	Cx2	500 kΩ // 30 nF 1000
X3 (3)	All devices		Cx3	1 nF 2000 V
	CANopen	yes	Cx4 + Cx5	Cx4 = (1 MΩ // 15 nF 1000 V) Cx5 = 0 Ω
	DeviceNet	yes	Cx4 + Cx5	Je (1 MΩ // 15 nF 1000 V)

Table 42: Galvanic Isolation NB 100-RS-DN/CO Device

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5 Mounting and Dismounting

5.1 Safety Messages on Personal Injury

Obey to the following safety messages on personal injury, when mounting, dismounting or replacing the netBRICK NB 100 device.

5.1.1 Use in Hazardous Locations only in Scope of the UL Standards

The Use in Hazardous Locations with Potentially Explosive Atmosphere is only allowed in Scope of the UL Standards!

Important! Outside the scope of the UL standards you are allowed to use the netBRICK NB 100 device in **non-hazardous locations** only!

When using the device in hazardous locations with potentially explosive atmosphere according to UL (UL-Report/File E326833) you must observe the following safety messages.

WARNING

Explosion Hazard!

- Do not connect or disconnect the netBRICK NB 100 device unless power has been removed or the area is known to be non-hazardous.
- Substitution of components may impair suitability for NEC500 Class I, Division 2, Groups A, B, C, and D.
- Do not use the diagnostic interface **DIAG** (USB connector) of the netBRICK NB 100 device in hazardous locations. Use the diagnostic interface DIAG only, if power has been removed or the area is known to be non-hazardous.
- Use only a power supply specified according to the UL standard.

5.1.2 Danger of unsafe System Operation

WARNING

Danger of unsafe System Operation

To prevent harm of persons, do not remove this device under runtime conditions before you can not guarantee further a safe and secure operation of the plant.

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5.2 Property Damage Messages

Obey to the following property damage messages, when mounting the netBRICK NB 100 device.

5.2.1 Device Destruction by exceeding allowed Supply Voltage

NOTICE

Device Destruction!

- Use only the permissible supply voltage to operate the netBRICK NB 100 device.
- Operating the netBRICK NB 100 device with a supply voltage above of the specified range leads to device destruction.

5.2.2 Electrostatically sensitive Devices

NOTICE

Electrostatically sensitive Devices

- To prevent damage to the netBRICK NB 100 device, make sure, that you are discharged when you open the diagnostic interface DIAG (USB connector) of the netBRICK NB 100 device.

5.2.3 Danger of unsafe System Operation

NOTICE

Danger of unsafe System Operation

To prevent property damage, do not remove this device under runtime conditions before you can not guarantee further a safe and secure operation of the plant.

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5.3 Mounting

The devices can be mounted adjacent to each other.

In case angled connectors are used, take into account that the connectors are pointing always from device in an angle of 45°. This is why you have to take care about the spacing for the cable run.

The device should be mounted on a metallic surface. At least the holes ⑨ and ⑪ (Figure 5 on page 31) have to be securely connected to a metal plate that is connected to the potential equalization. This establishes also the earthing of the M12 connectors.

For mounting of the device use screws of type M4 with an overall length of at least > 6 mm.

Information about the drilling template is in section *Drilling Template* on page 29.

5.3.1 Use in Hazardous Locations only in Scope of the UL Standards

The Use in Hazardous Locations with Potentially Explosive Atmosphere is only allowed in Scope of the UL Standards!

Important! Outside the scope of the UL standards you are allowed to use the netBRICK NB 100 device in **non-hazardous locations** only!

When using the device in hazardous locations with potentially explosive atmosphere according to UL (UL-Report/File E326833) you must observe the following safety messages.

⚠ WARNING

Explosion Hazard!

- Do not connect the netBRICK NB 100 device unless power has been removed or the area is known to be non-hazardous.
- Use only a power supply specified according to the UL standard.

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5.4 Dismounting

WARNING

Danger of unsafe System Operation!

- To prevent harm of persons and property damage, do not remove this device under runtime conditions before you can not guarantee further a safe and secure operation of the plant.

NOTICE

Danger of unsafe System Operation!

- To prevent property damage, do not remove this device under runtime conditions before you can not guarantee further a safe and secure operation of the plant.

Take care that no liquid enter into the connectors during dismounting the device.

5.4.1 Use in Hazardous Locations only in Scope of the UL Standards

When using the device in hazardous locations with potentially explosive atmosphere according to UL (UL-Report/File E326833) you must observe the following safety messages.

WARNING

Explosion Hazard!

- Do not connect or disconnect the netBRICK NB 100 device unless power has been removed or the area is known to be non-hazardous.
- Substitution of components may impair suitability for NEC500 Class I, Division 2, Groups A, B, C, and D.

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6 Install Driver

Always use the installation program to install the USB driver. The installation program is named *setup.exe* and is on the Gateway Solution DVD in the folder `Setups & Drivers\USB Driver`.

Install the USB driver at first, before you connect the netBRICK NB 100 gateway to the USP port of your PC the first time.

Windows XP: The **Found New Hardware Wizard** appears under Windows XP, when you connect the gateway to the USB port for the first time. Select the **Install the software automatically** option in the wizard, if the USB driver is installed on your PC.

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7 Commissioning

7.1 Commissioning

Obey to the following property damage messages, when commissioning the netBRICK NB 100 device.

NOTICE

Electrostatically sensitive Devices

- To prevent damage to the netBRICK NB 100 device, make sure, that you are discharged when you open the diagnostic interface DIAG (USB connector) of the netBRICK NB 100 device.

It is necessary for commissioning that the device is loaded with relevant configuration data.

The configuration can be created and saved offline with or without real device on a standard PC with the software SYCON.net. The configuration can be downloaded into the device in two steps afterwards.

Information about the configuration of the protocol conversion of the device is in the operating instruction manual *Configuration of Gateway and Proxy Devices OI xx EN.pdf* on the DVD in the directory `Documentation`.

The configuration is saved in the device in a non-volatile flash memory. Once set the data will be available after each power cycle.

The power up behavior after a power cycle is described in the chapter *Boot up Behavior* on page 52.

7.2 Maintainance

Obey to the following property damage messages, when maintaining the netBRICK NB 100 device.

NOTICE

Electrostatically sensitive Devices

- To prevent damage to the netBRICK NB 100 device, make sure, that you are discharged when you open the diagnostic interface DIAG (USB connector) of the netBRICK NB 100 device.

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7.3 Boot up Behavior

7.3.1 Boot up Behavior on valid Firmware

During the power up cycle the configuration and firmware data are copied from the flash memory into the RAM of the netX 100 CPU. The firmware is then started. This procedure may take (configuration data size dependent) some seconds (usually 4 seconds).

7.3.2 Boot up Behavior on invalid Firmware

If after the power up cycle the LED SYS (13) known from *Figure 5: LEDs and Control Elements* on page 31 is flashing yellow / green at a rate of 1 Hz, the firmware of the device is invalid or has been destroyed. In this case there is no further access possible with the configuration tool SYCON.net. The device has fallen back into bootloader mode.

The device has to be recovered to the factory default settings.

7.3.2.1 Recover to Factory Default Settings

In case there is no further communication possible via and the configuration tool SYCON.net because a firmware download has failed for example, then a special recovery procedure can bring back the device back to life.

In this special state the LED SYS (No. (13) known from *Figure 5: LEDs and Control Elements* on page 31 is flashing yellow / green at 1 Hz.

In case a NB 100 device is connected in this very special state to the USB port of a PC, windows will ask for a new USB driver, even if you have already installed it before. Please follow the instructions in the section *USB Driver Installation in Bootloader Mode as „netX boot monitor“* on page 53 to install the driver.

Just in the case that no driver installation is requested (cause the device has been previously connected in this state before already) please follow the instructions in the section *Load Firmware in Boot Loader* Mode on page 57.

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7.3.2.2 USB Driver Installation in Bootloader Mode as „netX boot monitor“

Note: The following section only need to be done in case of an error, if the firmware download into the devices was not completed without error. (Loss of power or line interruption during the firmware download).

After establishing the USB cable connection and powering the device, windows will ask you for the USB driver with the following window:

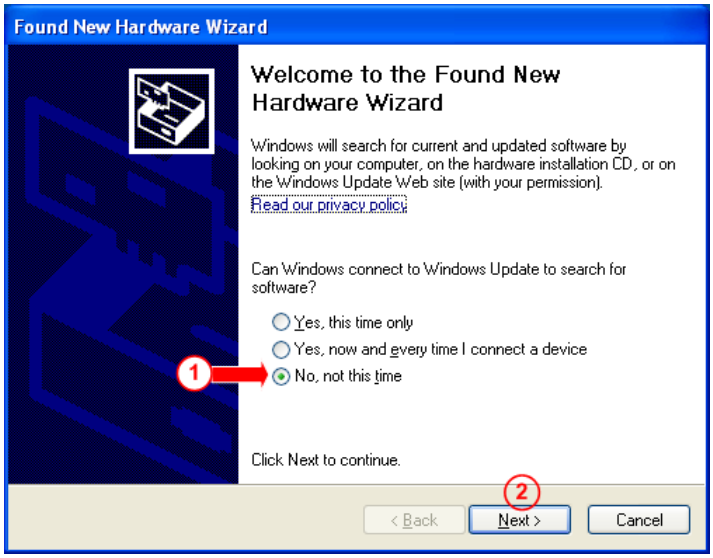
Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
Windows will search for current and updated software by looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission).
Read our privacy policy
Can Windows connect to Windows Update to search for software?
Yes, this time only
Yes, now and every time I connect a device
No, not this time
1
Click Next to continue.
2
< Back
Next >
Cancel

Figure 12: USB Installation in Bootloader Mode Step 1

- Insert the DVD included in the delivery into the DVD drive of your PC.
- Select **No, not this time** ①. Afterwards click **Next** ②.

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The following window will be opened.

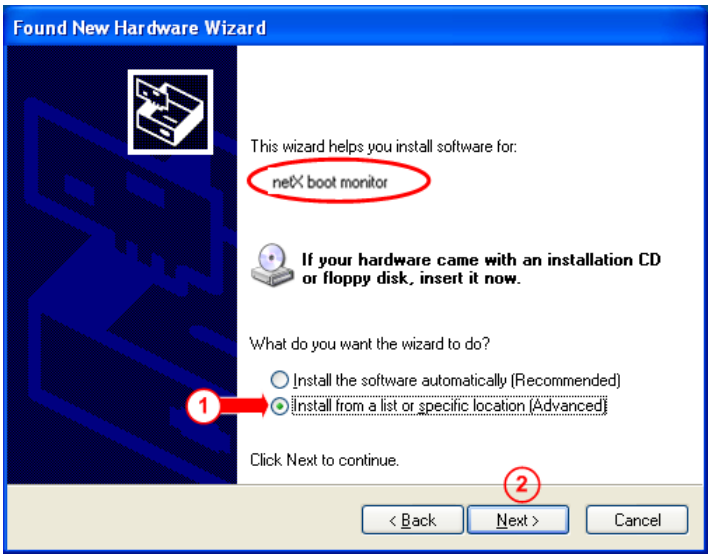
Found New Hardware Wizard
This wizard helps you install software for:
netX boot monitor
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
1
2
< Back
Next >
Cancel

Figure 13: USB Installation in Bootloader Mode Step 2

- Select in this windows the option **Install from a list or specific location** and click **Next** (2).

The following window will appear.

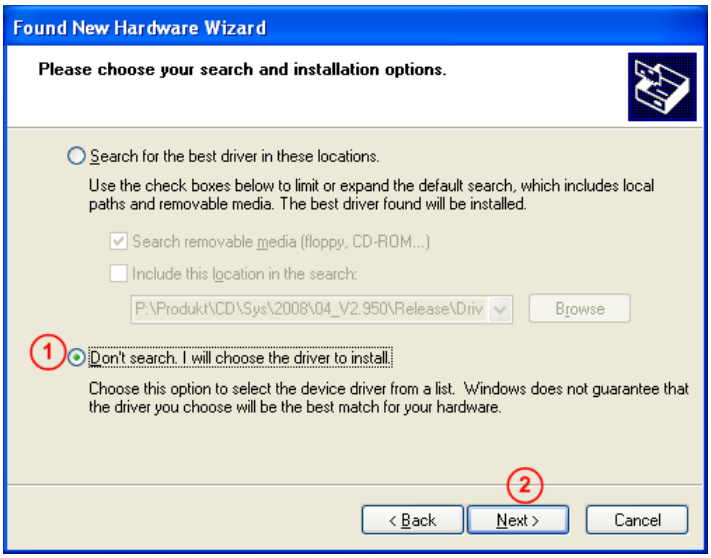
Found New Hardware Wizard
Please choose your search and installation options.
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM...)
Include this location in the search:
P:\Produkt\CD\Sys\2008\04_V2.950\Release\Driv
Browse
1
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
2
< Back
Next >
Cancel

Figure 14: USB Installation in Bootloader Mode Step 3

- Select **Don't search ...** (1) and then click **Next** (2).

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The following window will be opened.

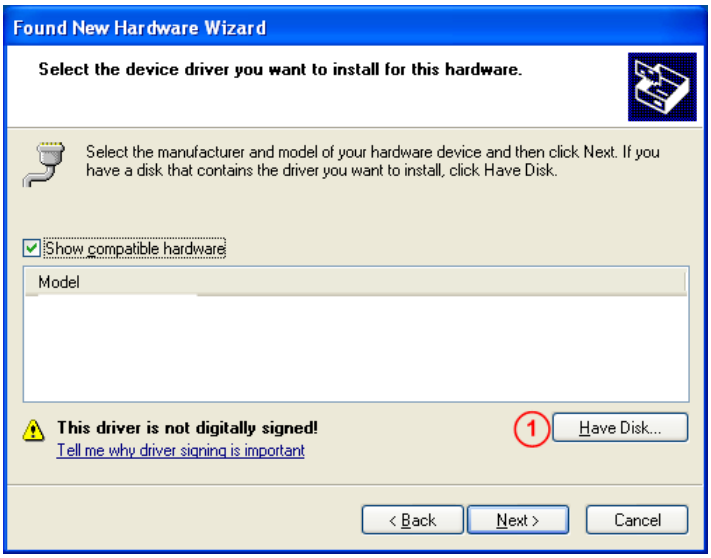
Found New Hardware Wizard
Select the device driver you want to install for this hardware.
Select the manufacturer and model of your hardware device and then click Next. If you have a disk that contains the driver you want to install, click Have Disk.
Show compatible hardware
Model
This driver is not digitally signed!
Tell me why driver signing is important
1
Have Disk...
< Back
Next >
Cancel

Figure 15: USB Installation in Bootloader Mode Step 4

- Select the option **Have Disk** (1).

The following window will be opened.

Figure 16: USB Installation in Bootloader Mode Step 5

- Click **Browse** (1).
- In the opening file explorer move to the DVD folder `Setups & Drivers\USB Driver\USB netX50_51_52 and netX100`
  and select the file `netX_usb_cdc.inf`.
- After returning to this window click **OK** (2).

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You will return back to the following window.

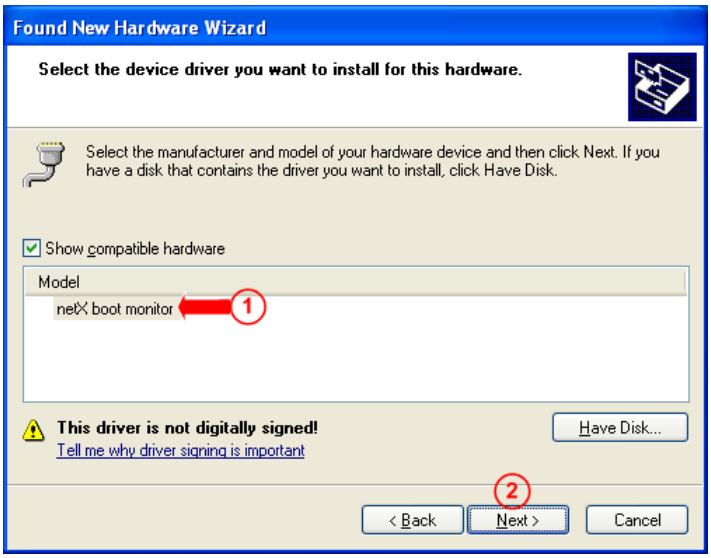
Found New Hardware Wizard
Select the device driver you want to install for this hardware.
Select the manufacturer and model of your hardware device and then click Next. If you have a disk that contains the driver you want to install, click Have Disk.
Show compatible hardware
Model
netX boot monitor
1
This driver is not digitally signed!
Tell me why driver signing is important
Have Disk...
2
< Back
Next >
Cancel

Figure 17: USB Installation in Bootloader Mode Step 6

- Select **netX boot monitor** (1) (even if there are other entries shown, please select this one) and confirm with **Next** (2).

The following window will be opened.

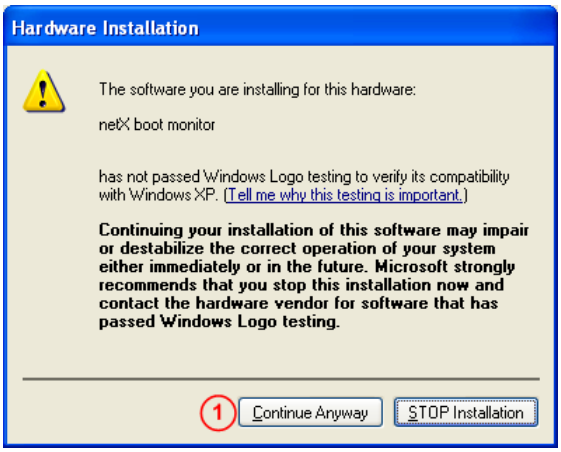
Hardware Installation
The software you are installing for this hardware:
netX boot monitor
has not passed Windows Logo testing to verify its compatibility with Windows XP. (Tell me why this testing is important.)
Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the hardware vendor for software that has passed Windows Logo testing.
1
Continue Anyway
STOP Installation

Figure 18: USB Installation in Bootloader Mode Step 7

- Confirm with **Continue Anyway** (1).
- Wait until the driver has been properly installed.
- Continue with section Load Firmware in Boot Loader Mode on page 57.

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7.3.2.3 Load Firmware in Boot Loader Mode

- Start directly from the DVD `Supplements & Examples\Device Recovery\netBRICK 100 Factory Settings\Recovery via USB\comproX.exe`.
- Alternatively, copy all files from `Supplements & Examples\Device Recovery\netBRICK 100 Factory Settings\Recovery via USB` onto your PC and then start `comproX.exe`.
- The following window will be opened.

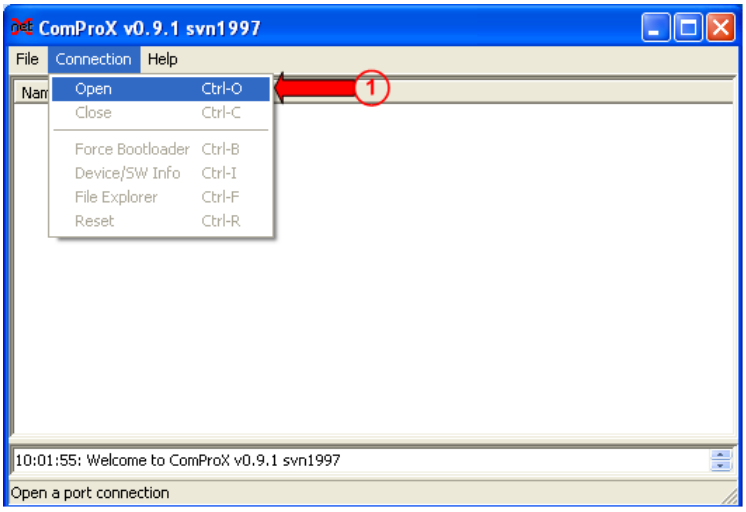

Figure 19: ComProX Start

- Select the drop down menu **Connection > Open** (1).
- The following window will be opened.

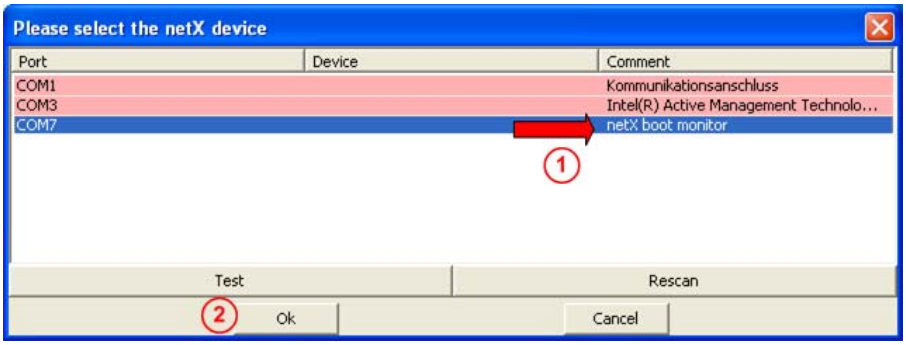

Figure 20: ComProX Choice of Connection

- Select **netX boot monitor** (1) and confirm with **OK** (2).

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You are forwarded back to the program's start screen.

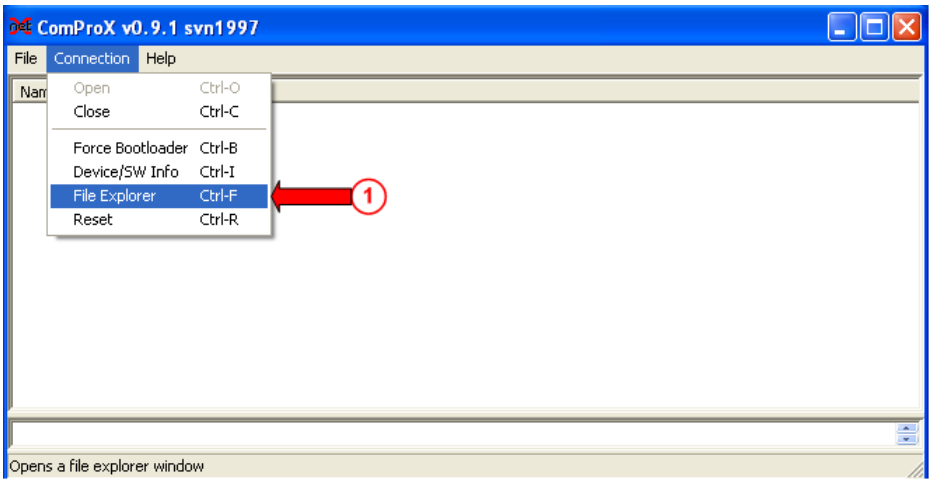

Figure 21: ComProX Choice File Explorer

➢ Select now from the drop down menu **Connection > File Explorer** (1).

The following additional windows will be opened.

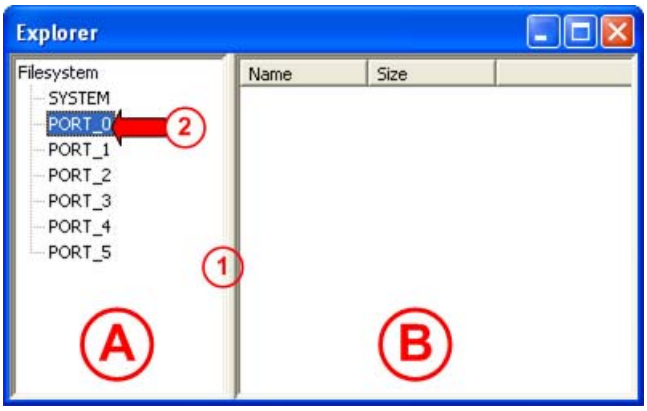

Figure 22: ComProX File Explorer - NB 100 File System Structure

➢ In order to see the file system of the device in the window area (A) move the dividing line (1) slightly to the right.

➢ Select in the window area (A) the entry **PORT_0** (2) and do a right mouse click afterwards in the window area (B).

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The following dialog menu will be opened.

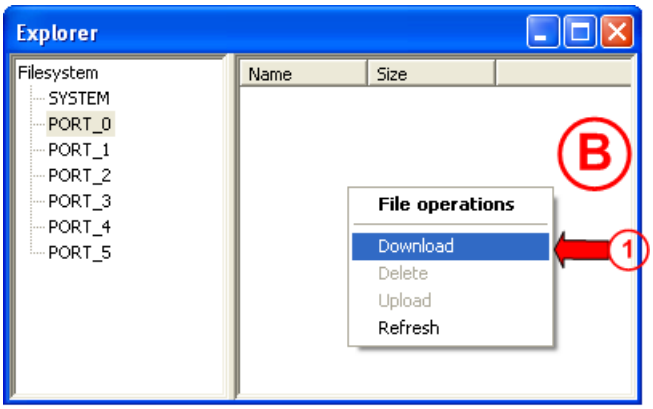

Figure 23: ComProX File Explorer - File Menu 1

- Select from the drop down menu the entry **Download** (1).
- The standard file explorer of your windows will be opened
- Move on the DVD to folder `Supplements & Examples\Device Recovery\netBRICK 100 Factory Settings\Recovery via USB\Recovery via USB` or move to the local folder and select the file `NBBASEFW.NXF`.
- Loading the firmware may take some seconds.
- Right mouse click into the window area (B) of the window above.
- The following dialog menu will be opened.

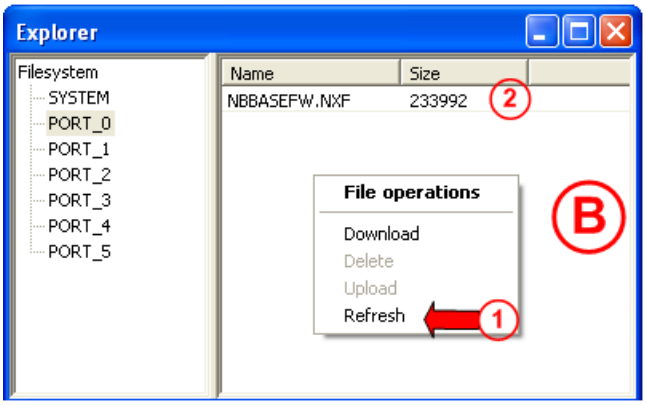

Figure 24: ComProX File Explorer - File Menu 2

- Select **Refresh** (1).
- In case the download was successful ComProX will show you the download firmware as shown at (2).
- Close the window above and close the main window of ComProX.
- Remove the power from your device and perform a power cycle.

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- The device will be restarted and the firmware will be started. Now the LED SYS (No. 13 known from Figure 5: LEDs and Control Elements on page 31) will be on green and the LED APL (No. 7 known from LEDs and Control Elements on page 31) flashes red.

The reset to factory settings has successfully been executed. Now you can access to the device again with the configuration tool SYCON.net via the USB port. From there you can now download the firmware of your choice.

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8 Troubleshooting

Two methods for troubleshooting exist:

- The visual analysis of the LED conditions of the device
- The analysis via the USB port along with the configuration tool SYCON.net.

The following overview describes the error conditions that may be detected by a visual check of the LEDs.

In order to find the correct position of the LEDs please follow the chapter *Positions of LEDs and* Control Elements from page 31. The numbers in the column LED state is referencing the position number in the device drawing.

LED state	Remedy
No LED is on	The device is not powered or the device has a malfunction and needs replacement
SYS LED ⑤ flashes yellow/green at 1 Hz	After a power cycle the device has not found a valid firmware and remains in bootloader mode. The device has to be recovered and set back to factory setting. Follow the chapter "*Recover to Factory Default Settings*" on page 52.
SYS LED ⑤ on yellow	The device has a malfunction and needs replacement.
SYS LED ⑤ on green APL LED ⑥ red on or flashing red	The device is well initialized. Further analysis is possible with the LED ⑥ APL. Follow the chapter "*LED APL*" on page 63.
APL LED ⑥ flashing green	The communication via port X2 or/and port X3 is not in data exchange mode. See chapter "*LED APL*" on page 63.

Table 43: NB 100 Troubleshooting

The device is operational just in case the described error conditions above do not met. Further protocol specific error diagnostics via the LEDs is possible by reading on the chapter "LED".

In deep diagnostics is possible at any time via the USB diagnostic port of the device and a PC with the software SYCON.net.

In case of trouble you should make sure that you have downloaded a correct signal mapping to the device via SYCON.net

For some protocols it is necessary to synchronize data via a handshake between the gateway and the superordinated PLC. Please make sure that the handshake mechanism is kept.

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8.1 Failure in 10 MBit/s Half Duplex Mode and Workaround

Only older devices are affected that have a serial number below the number listed in the following table.

Device type NB 100-RE-xx	Serial number below
NB 100-RE-CO	20025
NB 100-RE-DP	20027
NB 100-RE-DN	20020

Affected Hardware

Hardware with the communication controller netX 50, netX 100 or netX 500; netX/Internal PHYs.

When can this Failure occur?

When using standard Ethernet communication with 10 MBit/s half duplex mode, the PHY gets stuck in case of network collisions. Then no further network communication is possible. Only device power cycling allows Ethernet communication again.

This problem can only occur with Ethernet TCP/UDP IP, EtherNet/IP or Modbus TCP protocols when using hubs at 10 MBit/s. The issue described above is not applicable for protocols which use 100 MBit/s or full duplex mode.

Solution / Workaround:

Do not use 10 MBit/s-only hubs. Use either switches or 10/100 MBit/s Dual Speed hubs, to make sure the netX Ethernet ports are connected with 100 MBit/s or in full duplex mode.

This erratum is fixed with all components of the ‘Y’ charge (9 digit charge number shows ‘Y’ at position 5 (nnnnYnnnn).

Reference

“Summary of 10BT problem on EthernetPHY”,
RenesasElectronics Europe, April 27, 2010

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9 LEDs

In order to find the correct position of the LEDs please follow the chapter *Positions of LEDs and Control Elements* from page 31. The numbers in the column LED state is referencing the position number in the device drawing.

9.1 LED SYS

The subsequent table describes the meaning of the system LED.

LED	Color	State	Meaning
SYS Number in the device drawing 13	**Duo LED yellow/green**		
	(green)	On	Operating System running
	(yellow)	static	Bootloader is waiting for software This state may occur only briefly. If this LED stays permanently yellow, then a hardware failure is possible.
	(yellow)	Flashing	The device doesn't work. In the USB cable attached to the device has pin 4 connected with ground. ➢ Remove the USB cable from the device. Disconnect the power supply to the device. Reconnect the power supply to the device. After some seconds reconnect the USB cable to the device. ➧ The device is working.
	(yellow /green)	Flashing yellow/green	Boot loader active.
	(off)	Off	Power supply for the device is missing or hardware defect.

Table 44: System LED

9.2 LED APL

LED	Color	State	Meaning
APL Number in device drawing 7	**Duo LED green/read**		
	(green)	On	The communication on X2 and X3 is in cyclic data exchange and the gateway function is executed
	(green)	Blinking with 2 s off, 0,5 s on	netBRICK is initialized, but the communication on X2 is not in cyclic data exchange.
	(green)	Blinking with 2 s off, 0,5 s on, 0,5 s off, 0,5 s on,	netBRICK is initialized, but the communication on X3 is not in cyclic data exchange.
	red)	Blinking with 2 s off, 0,5 s on	netBRICK is initialized, but the configuration for the communication protocol on X2 is missing or has an error
	(red)	Blinking with 2 s off, 0,5 s on, 0,5 s off, 0,5 s on,	netBRICK is initialized, but the configuration for the communication protocol on X3 is missing or has an error
	(red)	On	netBRICK has detected an error during the initialization: Missing configuration, error in configuration or internal error

Table 45: LED APL

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9.3 LEDs Real Time Ethernet Systems

9.3.1 LED EtherCAT Master

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the EtherCAT Master protocol is loaded to the device.

LED	Color	State	Meaning
RUN Name in the device drawing: **COM0** (14)	**Duo LED red/green**		
	(off)	Off	**INIT**: The device is in state INIT
	(green)	Blinking	**PRE-OPERATIONAL**: The device is in PRE-OPERATIONAL state
	(green)	Flickering	**BOOT**: Device is in Boot mode
	(green)	Single Flash	**SAFE-OPERATIONAL**: The device is in SAFE-OPERATIONAL state
	(green)	On	**OPERATIONAL**: The device is in OPERATIONAL state
ERR Name in the device drawing: **COM1** (6)	**Duo LED red/green**		
	(off)	Off	Master has no errors
	(red)	On	Master has detected a communication error. The error is indicated in the DPM
LINK RJ45 Ch0 (17)	**LED green**		
	(green)	On	A link is established
	(off)	Off	No link established
ACT RJ45 Ch0 (15)	**LED yellow**		
	(yellow)	Flickering	The device sends/receives Ethernet frames
	(off)	Off	Device has no configuration

Table 46: LEDs EtherCAT Master

LED State Definition for EtherCAT Master for the RUN (14) and ERR LEDs (6)

Indicator state	Definition
On	The indicator is constantly on.
Off	The indicator is constantly off.
Blinking	The indicator turns on and off with a frequency of 2,5 Hz: on for 200 ms, followed by off for 200 ms.
Flickering	The indicator turns on and off with a frequency of approximately 10 Hz: on for approximately 50 ms, followed by off for 50 ms.
Single Flash	The indicator shows one short flash (200 ms) followed by a long off phase (1,000 ms).

Table 47: LED State Definition for EtherCAT Master for the RUN and ERR LEDs

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9.3.2 LED EtherCAT Slave

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the EtherCAT Slave protocol is loaded to the device.

LED	Color	State	Meaning
RUN Number in the device drawing: **COM0** (14)	**Duo LED red/green**		
	(off)	Off	**INIT**: The device is in state INIT
	(green)	Blinking	**PRE-OPERATIONAL**: The device is in state PRE-OPERATIONAL
	(green)	Single Flash	**SAFE-OPERATIONAL**: The device is in state SAFE-OPERATIONAL
	(green)	On	**OPERATIONAL**: The device is in state OPERATIONAL
ERR Number in the device drawing: **COM1** (6)	**Duo LED red/green**		
	(off)	Off	**No error**: The EtherCAT communication of the device is in working condition
	(red)	Blinking	**Invalid Configuration**: General Configuration Error (Example: State change commanded by master is impossible due to register or object settings.)
	(red)	Single Flash	**Unsolicited State Change**: Slave device application has changed the EtherCAT state autonomously: Parameter "Change" in the AL status register is set to 0x01:change/error (Example: Synchronization Error, device enters Safe-Operational automatically.)
	(red)	Double Flash	**Application Watchdog Timeout**: An application watchdog timeout has occurred. (Example: Sync Manager Watchdog timeout)
	(red)	On	**PDI Watchdog Timeout**: A PDI Watchdog timeout has occurred (Example: Application controller is not responding any more)
L/A IN RJ45 Ch0 (17) **L/A OUT** RJ45 Ch1 (3)	**LED green**		
	(green)	On	A link is established
	(green)	Flashing	The device sends/receives Ethernet frames
	(off)	Off	No link established
RJ45 Ch0 (15) RJ45 Ch1 (5)	**LED yellow**		
	-	-	This LED is not used.

Table 48: LEDs EtherCAT Slave

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LED State Definition for EtherCAT Slave for the LEDs RUN (14) and ERR LED (6)

Indicator state	Definition
On	The indicator is constantly on.
Off	The indicator is constantly off.
Blinking	The indicator turns on and off with a frequency of 2,5 Hz: on for 200 ms, followed by off for 200 ms.
Single Flash	The indicator shows one short flash (200 ms) followed by a long off phase (1,000 ms).
Double Flash	The indicator shows a sequence of two short flashes (each 200 ms), separated by a short off phase (200 ms). The sequence is finished by a long off phase (1,000 ms).

Table 49: LED State Definition for EtherCAT Slave for the RUN and ERR LEDs

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9.3.3 LED EtherNet/IP Scanner (Master)

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the EtherNet/IP Scanner (Master) protocol is loaded to the device.

LED	Color	State	Meaning
MS Number in the device drawing **COM0** 14	**Duo LED red/green**		
	(green)	On	**Device operational**: If the device is operating correctly, the module status indicator shall be steady green.
	(green)	Flashing	**Standby**: If the device has not been configured, the module status indicator shall be flashing green.
	(red)	On	**Major fault**: If the device has detected a non-recoverable major fault, the module status indicator shall be steady red.
	(red)	Flashing	**Minor fault**: If the device has detected a recoverable minor fault, the module status indicator shall be flashing red. NOTE: An incorrect or inconsistent configuration would be considered a minor fault.
	(red/green)	Flashing	**Self-test**: While the device is performing its power up testing, the module status indicator shall be flashing green/red.
	(off)	Off	**No power**: If no power is supplied to the device, the module status indicator shall be steady off.
NS Number in the device drawing **COM1** 6	**Duo LED red/green**		
	(green)	On	**Connected**: If the device has at least one established connection (even to the Message Router), the network status indicator shall be steady green.
	(green)	Flashing	**No connections**: If the device has no established connections, but has obtained an IP address, the network status indicator shall be flashing green.
	(red)	On	**Duplicate IP**: If the device has detected that its IP address is already in use, the network status indicator shall be steady red.
	(red)	Flashing	**Connection timeout**: If one or more of the connections in which this device is the target has timed out, the network status indicator shall be flashing red. This shall be left only if all timed out connections are reestablished or if the device is reset.
	(red/green)	Flashing	**Self-test**: While the device is performing its power up testing, the network status indicator shall be flashing green/red.
	(off)	Off	**Not powered, no IP address**: If the device does not have an IP address (or is powered off), the network status indicator shall be steady off.
LINK/RJ45 Ch0 & Ch1 3 & 17	**LED green**		
	(green)	On	A connection to the Ethernet exists
	(off)	Off	The device has no connection to the Ethernet
ACT/RJ45 Ch0 & Ch1 5 & 15	**LED yellow**		
	(yellow)	Flashing	The device sends/receives Ethernet frames

Table 50: LEDs EtherNet/IP Scanner (Master)

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9.3.4 LED EtherNet/IP Adapter (Slave)

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the EtherNet/IP Adapter (Slave) protocol is loaded to the device.

LED	Color	State	Meaning
MS Number in the device drawing: **COM0** (14)	**Duo LED red/green**		
	(green)	On	**Device operational**: If the device is operating correctly, the module status indicator shall be steady green.
	(green)	Flashing	**Standby**: If the device has not been configured, the module status indicator shall be flashing green.
	(red)	On	**Major fault**: If the device has detected a non-recoverable major fault, the module status indicator shall be steady red.
	(red)	Flashing	**Minor fault**: If the device has detected a recoverable minor fault, the module status indicator shall be flashing red. NOTE: An incorrect or inconsistent configuration would be considered a minor fault.
	(red/green)	Flashing	**Self-test**: While the device is performing its power up testing, the module status indicator shall be flashing green/red.
	(off)	Off	**No power**: If no power is supplied to the device, the module status indicator shall be steady off.
NS Number in the device drawing: **COM1** (6)	**Duo LED red/green**		
	(green)	On	**Connected**: If the device has at least one established connection (even to the Message Router), the network status indicator shall be steady green.
	(green)	Flashing	**No connections**: If the device has no established connections, but has obtained an IP address, the network status indicator shall be flashing green.
	(red)	On	**Duplicate IP**: If the device has detected that its IP address is already in use, the network status indicator shall be steady red.
	(red)	Flashing	**Connection timeout**: If one or more of the connections in which this device is the target has timed out, the network status indicator shall be flashing red. This shall be left only if all timed out connections are reestablished or if the device is reset.
	(red/green)	Flashing	**Self-test**: While the device is performing its power up testing, the network status indicator shall be flashing green/red.
	(off)	Off	**Not powered, no IP address**: If the device does not have an IP address (or is powered off), the network status indicator shall be steady off.
LINK/RJ45 Ch0 & Ch1 (17) & (3)	**LED green**		
	(green)	On	A connection to the Ethernet exists
	(off)	Off	The device has no connection to the Ethernet
ACT/RJ45 Ch0 & Ch1 (15) & (5)	**LED yellow**		
	(yellow)	Flashing	The device sends/receives Ethernet frames

Table 51: LEDs EtherNet/IP Adapter (Slave)

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9.3.5 LED Open Modbus/TCP

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the Open Modbus/TCP protocol is loaded to the device.

LED	Color	State	Meaning
RUN Number in the device drawing: **COM0** 14	**Duo LED red/green**		
	(off)	Off	**Not Ready** OMB task is not ready
	(green)	Flashing cyclic with 1Hz	**Ready, not configured yet** OMB task is ready and not configured yet
	(green)	Flashing cyclic with 5Hz	**Waiting for Communication:** OMB task is configured
	(green)	On	**Connected:** OMB task has communication – at least one TCP connection is established
ERR Number in the device drawing: **COM1** 6	**Duo LED red/green**		
	(off)	Off	No communication error
	(red)	Flashing cyclic with 2Hz (On/Off Ratio = 25 %)	System error
	(red)	On	Communication error active
LINK/RJ45 Ch0 & Ch1 17 & 3	**LED green**		
	(green)	On	A connection to the Ethernet exists
	(off)	Off	The device has no connection to the Ethernet
ACT/RJ45 Ch0 & Ch1 15 & 5	**LED yellow**		
	(yellow)	Flashing	The device sends/receives Ethernet frames

Table 52: LEDs Open Modbus/TCP

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9.3.6 LED POWERLINK Controlle Node/Slave

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the Powerlink Controlled Node/Slave protocol is loaded to the device.

LED	Color	State	Meaning
BS Number in the device drawing: **COM0** 14	**Duo LED red/green**		
	(off)	Off	Slave initializing
	(green)	Flickering	Slave is in Basic Ethernet state
		Single Flash	Slave is in Pre-Operational 1
		Double Flash	Slave is in Pre-Operational 2
		Triple Flash	Slave is in ReadyToOperate
		On	Slave is Operational
		Blinking	Slave is Stopped
BE Number in the device drawing: **COM1** 6	**Duo LED red/green**		
	(off)	Off	Slave has no error
	(red)	On	Slave has detected an error
L/A/RJ45 Ch0 & Ch1 17 & 3	**LED green**		
	(green)	On	**Link**: A connection to the Ethernet exists
	(green)	Flashing	**Activity**: The device sends/receives Ethernet frames
	(off)	Off	The device has no connection to the Ethernet
RJ45 Ch0 & Ch1 15 & 5	**LED yellow**		
	-	-	This LED is not used.

Table 53: LEDs Powerlink Controlled Node/Slave

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LED State Definition for Powerlink Controlled Node/Slave for the BS/BE LEDs

Indicator state	Definition
On	The indicator is constantly on.
Off	The indicator is constantly off.
Blinking	The indicator turns on and off with a frequency of approximately 2,5 Hz: on for approximately 200 ms, followed by off for 200 ms. Red and green LEDs shall be on alternately.
Flickering	The indicator turns on and off with a frequency of approximately 10 Hz: on for approximately 50 ms, followed by off for 50 ms. Red and green LEDs shall be on alternately.
Single Flash	The indicator shows one short flash (approximately 200 ms) followed by a long off phase (approximately 1,000 ms).
Double Flash	The indicator shows a sequence of two short flashes (each approximately 200 ms), separated by a short off phase (approximately 200 ms). The sequence is finished by a long off phase (approximately 1,000 ms).
Triple Flash	The indicator shows a sequence of three short flashes (each approximately 200 ms), separated by a short off phase (approximately 200 ms). The sequence is finished by a long off phase (approximately 1,000 ms).

Table 54: LED State Definition for Powerlink Controlled Node/Slave for the BS/BE LEDs

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9.3.7 LED PROFINET IO RT Controller

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the PROFINET IO-RT Controller protocol is loaded to the device.

LED	Color	State	Meaning
SF Name in the device drawing: **COM0** (14)	**Duo LED red/green**		
	(red)	On	(**together** *with BF „red ON“)* **No valid Master license**
	(red)	Flashing cyclic at 2 Hz	**System error**: Invalid configuration, Watchdog error or internal error
	(off)	Off	No error
BF Name in the device drawing: **COM1** (6)	**Duo LED red/green**		
	(red)	On	**No Connection:** No Link. *or (***together** *with SF „red ON“)* **No valid Master license**
	(red)	Flashing cyclic at 2 Hz	**Configuration fault:** not all configured IO-Devices are connected.
	(off)	Off	No error
LINK RJ45 Ch0 & Ch1 (17) & (3)	**LED green**		
	(green)	On	A connection to the Ethernet exists
	(off)	Off	The device has no connection to the Ethernet
RX/TX RJ45 Ch0 & Ch1 (15) & (5)	**LED yellow**		
	(yellow)	Flashing	The device sends/receives Ethernet frames

Table 55: LEDs PROFINET IO-RT Controller

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9.3.8 LED PROFINET IO-RT-Device

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the PROFINET IO-RT-Device protocol is loaded to the device.

LED	Color	State	Meaning
SF Number in the device drawing: **COM0** (14)	**Duo LED red/green**		
	(red)	On	Watchdog timeout; channel, generic or extended diagnosis present; system error
	(red)	Flashing cyclic at 2 Hz (for 3 sec.)	DCP signal service is initiated via the bus
	(off)	Off	No error
BF Number in the device drawing: **COM1** (6)	**Duo LED red/green**		
	(red)	On	No configuration; or low speed physical link; or no physical link
	(red)	Flashing cyclic at 2 Hz	No data exchange
	(off)	Off	No error
LINK/RJ45 Ch0 & Ch1 (17) & (3)	**LED green**		
	(green)	On	A connection to the Ethernet exists
	(off)	Off	The device has no connection to the Ethernet
RX/TX/RJ45 Ch0 & Ch1 (15) & (5)	**LED yellow**		
	(yellow)	Flashing	The device sends/receives Ethernet frames

Table 56: LEDs PROFINET IO-RT-Device

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9.3.9 LED sercos Master

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the sercos Master protocol is loaded to the device.

LED	Color	State	Meaning
S3 (STA) Name in the device drawing: **COM0** (14)	**Duo LED red/green**		
	(green)	Blinking	**CP0:** Communication phase 0
	(green)	Flickering	Master isn't configured and is in NRT. After a status change this isn't indicated again
	(green)	Single Flash	**CP1:** Communication phase 1
	(green)	Double Flash	**CP2:** Communication phase 2
	(green)	Triple Flash	**CP3:** Communication phase 3
	(green)	On	**CP4:** Communication phase 4
	(off)	Off	**NRT:** Non Real-time Mode
	(red)	Blinking	Error in the configuration database.
	(red)	Flickering	Boot-up was stopped due to an error.
	(red)	Single Flicker-ing	Channel Init was executed at the Master.
	(red)	Quadruple Flash	No Master license present in the device
	(red)	Triple Flash	DPM Watchdog has expired.
	(red)	Double Flash	Internal Stop of the bus cycle
	(red)	Single Flash	Bus Sync Error Threshold
Name in the device drawing: **COM1** (6)	**Duo LED red/green**		
	-	-	This LED is not used.
L/A RJ45 Ch0 & Ch1 (17) & (3)	**LED green**		
	(green)	On	Link: A connection to the Ethernet exists
	(green)	Flashing	Activity: The device sends/receives Ethernet frames
	(off)	Off	The device has no connection to the Ethernet
RJ45 Ch0 & Ch1 (15) & (5)	**LED yellow**		
	-	-	This LED is not used.

Table 57: LEDs sercos Master

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LED State Definition for sercos Master for the S3 (STA) 14 and ERR LEDs 6

Indicator state	Definition
Off	The indicator is constantly off.
Blinking	The indicator turns on and off with a frequency of 2,5 Hz: on for 200 ms, followed by off for 200 ms.
Single Flickering	The indicator turns on and off with a frequency of approximately 10 Hz: on for approximately 50 ms, followed by off for 50 ms.
Flickering	The indicator turns on and off once: on for approximately 50 ms, followed by off for 50 ms.
Single Flash	The indicator shows one short flash (200 ms) followed by a long off phase (1,000 ms).
Double Flash	The indicator shows a sequence of two short flashes (each 200 ms), separated by a short off phase (200 ms). The sequence is finished by a long off phase (1,000 ms).
Triple Flash	The indicator shows a sequence of three short flashes (each 200 ms), separated by a short off phase (200 ms). The sequence is finished by a long off phase (1,000 ms).
Quadruple Flash	The indicator shows a sequence of four short flashes (each 200 ms), separated by a short off phase (200 ms). The sequence is finished by a long off phase (1,000 ms).

Table 58: LED State Definition for sercos Master for the STA and ERR LEDs

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9.3.10 LED sercos Slave

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the sercos Slave protocol is loaded to the device.

LED	Color	State	Meaning
S3 (STA) Name in the device drawing: **COM 0** (14)	**Duo LED red/green/orange** (orange = red/green simultaneously)		
	(green)	On	**CP4:** Communication phase 4, Normal operation, no error
	(green)	Flashing (4 Hz)	**Loopback**: The network state has changed from „fast-forward“ to „loopback“.
	(red/ green)	Flashing (4 Hz), *The LED flashes at least for 2 seconds from red to green.*	**Communication Error**: Depends on IDN S-0-1003 (for details refer to `sercos Slave Protocol API.pdf` on the product DVD). Shows how long the Master may in the communication phases CP3 and CP4 not received Master SYNC telegrams.
	(red)	On	**SIII C1D**: Error detected according to sercos third generation Cass 1 Diagnosis.
	(orange)	On	**CP0 … CP3**: Communication phase 0 to Communication phase 3
	(orange)	Flashing (4 Hz)	**Identification**: Bit 15 in the Slave device control that indicates remote address allocation or configuration errors between Master and Slaves (for details refer to `sercos Slave Protocol API.pdf` on the product CD oder DVD).
	(off)	Off	No sercos Communication
Name in the device drawing: **COM 1** (6)	**Duo LED red/green**		
	-	-	This LED is not used.
L/A/RJ45 Ch0 & Ch1 (17) & (3)	**LED green**		
	(green)	On	Link: A connection to the Ethernet exists
	(green)	Flashing	Activity: The device sends/receives Ethernet frames
	(off)	Off	The device has no connection to the Ethernet
RJ45 Ch0 & Ch1 (15) & (5)	**LED yellow**		
	-	-	This LED is not used.

Table 59: LEDs sercos Slave

LED State Definition for sercos Slave for the S3 LED (STA LED) (14)

Indicator state	Definition
On	The indicator is constantly on.
Off	The indicator is constantly off.
Flashing (4 Hz)	The indicator turns on and off with a frequency of 4 Hz: on for appr. 125 ms, followed by off for appr. 125 ms.

Table 60: LED State Definition for sercos Slave for the S3 LED (STA LED)

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9.4 LEDs Fieldbus Systems

9.4.1 LED PROFIBUS DP Master

The subsequent table describes the meaning of the LEDs for the device when the firmware of the PROFIBUS DP Master protocol is loaded to the device.

LED	Color	State	Meaning
Communication LED			
COM 20 with protocol at X3	**Duo LED red/green**		
	(green)	Flashing acyclic	No configuration or stack error
	(green)	Flashing cyclic	Profibus is configured, but bus communication is not yet released from the application
	(green)	On	Communication to all Slaves is established
	(red)	Flashing cyclic	Communication to at least one Slave is disconnected
	(red)	On	Communication to one/all Slaves is disconnected

Table 61: LEDs PROFIBUS DP Master

9.4.2 LED PROFIBUS DP Slave

The subsequent table describes the meaning of the LEDs for the device when the firmware of the PROFIBUS DP Slave protocol is loaded to the device.

LED	Color	State	Meaning
COM 20 with protocol at X3	**Duo LED red/green**		
	(green)	On	RUN, cyclic communication.
	(red)	On	Wrong configuration at PROFIBUS-DPside.
	(red)	Flashing cyclic	STOP, no communication, connection error.
	(red)	Flashing acyclic	Not configured.

Table 62: LED PROFIBUS DP Slave

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9.4.3 LED CANopen Master

The subsequent table describes the meaning of the LEDs for the device when the firmware of the CANopen Master protocol is loaded to the device.

LED	Color	State	Meaning
Communication LED			
CAN ⑳ with protocol at X3	**Duo LED red/green**		
	(off)	Off	**RESET:** The device is executing a reset ort he device has no configuration.
	(green)	Single flash	**STOPPED:** The device is in STOPPED state.
	(green)	Blinking	**PREOPERATIONAL:** The device is in the PREOPERATIONAL state.
	(green)	On	**OPERATIONAL:** The device is in the OPERATIONAL state.
	(red)	Single flash	**Warning Limit reached:** At least one of the error counters of the CAN controller has reached or exceeded the warning level (too many error frames).
	(red)	Double flash	**Error Control Event:** A guard event (NMT Slave or NMT-master) or a heartbeat event (Heartbeat consumer) has occurred.
	(red)	On	**Bus Off:** The CAN controller is bus off.

Table 63: LED CANopen Master

LED State Definition for CANopen Master for the CAN LED ⑳ with protocol at X3

Indicator state	Definition
On	The indicator is constantly on.
Off	The indicator is constantly off.
Flickering	The indicator turns on and off with a frequency of 10 Hz: on for 50 ms, followed by off for 50 ms.
Blinking	The indicator turns on and off with a frequency of 2,5 Hz: on for 200 ms, followed by off for 200 ms.
Single Flash	The indicator shows one short flash (200 ms) followed by a long off phase (1,000 ms).
Double Flash	The indicator shows a sequence of two short flashes (each 200 ms), separated by a short off phase (200 ms). The sequence is finished by a long off phase (1,000 ms).

Table 64: LED State Definition for CANopen Master for the CAN LED

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9.4.4 LED CANopen Slave

The subsequent table describes the meaning of the LEDs for the device when the firmware of the CANopen Slave protocol is loaded to the device.

LED	Color	State	Meaning
CAN with protocol at X3	**Duo LED red/green**		
	(off)	Off	**RESET:** The device is executing a reset
	(green)	Single flash	**STOPPED:** The device is in STOPPED state
	(green)	Blinking	**PREOPERATIONAL:** The device is in the PREOPERATIONAL state
	(green)	On	**OPERATIONAL:** The device is in the OPERATIONAL state
	(red/green)	Flickering (alternatively red / green)	**Auto Baud Rate Detection active:** The Device is in the Auto Baud Rate Detection mode
	(red)	Single flash	**Warning Limit reached:** At least one of the error counters of the CAN controller has reached or exceeded the warning level (too many error frames).
	(red)	Double flash	**Error Control Event:** A guard event (NMT Slave or NMT-master) or a heartbeat event (Heartbeat consumer) has occurred.
	(red)	On	**Bus Off:** The CAN controller is bus off

Table 65: LEDs CANopen Slave

LED State Definition for CANopen Slave for the CAN LED

Indicator state	Definition
On	The indicator is constantly on.
Off	The indicator is constantly off.
Flickering	The indicator turns on and off with a frequency of 10 Hz: on for 50 ms, followed by off for 50 ms.
Blinking	The indicator turns on and off with a frequency of 2,5 Hz: on for 200 ms, followed by off for 200 ms.
Single Flash	The indicator shows one short flash (200 ms) followed by a long off phase (1,000 ms).
Double Flash	The indicator shows a sequence of two short flashes (each 200 ms), separated by a short off phase (200 ms). The sequence is finished by a long off phase (1,000 ms).

Table 66: LED State Definition for CANopen Slave for the CAN LED

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9.4.5 LED DeviceNet Master

The subsequent table describes the meaning of the LEDs for the fieldbus device when the firmware of the DeviceNet Master protocol is loaded to the device.

LED	Color	State	Meaning
MNS with protocol at X3	**Duo LED red/green**		
	(green)	On	Device is online and has one or more connections in the established state
	(green)	Flashing	Device is online and has no connection in the established state
	(green/red/ off)	Green/Red/ Off	Selftest after power on: Green on for 0,25 s, then red on for 0,25 s, then off
	(red)	Flashing	Connection timeout
	(red)	On	Critical connection failure; device has detected a network error: duplicate MAC-ID or sever error in CAN network (CAN-bus off)
	(off)	Off	After start of the device and during duplicate MAC-ID check

Table 67: LEDs DeviceNet Master

9.4.6 LED DeviceNet Slave

The subsequent table describes the meaning of the LEDs for the fieldbus device when the firmware of the DeviceNet Slave protocol is loaded to the device.

LED	Color	State	Meaning
MNS with protocol at X3	**Duo LED red/green**		
	(green)	On	Device is online and has one or more connections in the established state
	(green)	Flashing	Device is online and has no connection in the established state
	(green/red/ off)	Green/Red/ Off	Selftest after power on: Green on for 0,25 s, then red on for 0,25 s, then off
	(red)	On	Critical connection failure; device has detected a network error: duplicate MAC-ID or sever error in CAN network (CAN-bus off)
	(red)	Flashing	Connection timeout
	(off)	Off	After start of the device and during duplicate MAC-ID check

Table 68: LEDs DeviceNet Slave

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9.5 LEDs Serial

9.5.1 LED Modbus RTU

The subsequent table describes the meaning of the LEDs for the Modbus RTU protocol.

LED	Color	State	Meaning
COM (14)	**Duo LED red/green**		
	(green)	On	The device has a valid configuration for Modbus RTU and is ready for Modbus communication respectively sends/receives Modbus RTU telegrams
	(red)	On	Communication error: The device works as **Modbus RTU Master**: - the slave device answered with a error (Modbus Exception), e. g. functioncode not supported, access to invalid register addresses or coil addresses - receive error detected, e. g. parity error or checksum error - timeout (slave device does not answer) The device works as **Modbus RTU Slave**: - the Modbus RTU Master device uses an invalid functioncode - the Modbus RTU Master device has accessed an invalid register addresses or coil addresses - receive error detected, e. g. parity error or checksum error - timeout (application does not answer or answers with error) The error display is set back with the next error free Modbus telegram sequence
	(off)	Off	During initialisation or invalid Modbus RTU configuration or missing power supply

Table 69: LEDs Modbus RTU Protocol

9.5.2 LED ASCII

The subsequent table describes the meaning of the LEDs for the ASCII protocol.

LED	Color	State	Meaning
COM (14)	**Duo LED red/green**		
	(green)	Flashing cyclic with 5 Hz	The device sends/receive data
	(green)	On	The device is ready for serial communication
	(red)	Flashing cyclic with 5 Hz	The device is configured and is in the state stop
	(red)	Flashing cyclic with 1 Hz	The device is not configured
	(off)	Off	During initialisation or missing power supply

Table 70: LEDs ASCII Protocol

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9.5.3 LED 3964R

The subsequent table describes the meaning of the LEDs for the 3964R protocol.

LED	Color	State	Meaning
COM (14)	**Duo LED red/green**		
	(green)	Flashing cyclic with 10 Hz	The device sends/receive data
	(green)	On	The device is ready for serial communication
	(red)	On	Communication error: - receive error detected, e. g. parity error or checksum error - timeout (remote device does not answer) The error display is set back with the next error free 3964R telegram sequence
	(red)	Flashing cyclic with 5 Hz	The device is configured and is in the state stop
	(red)	Flashing cyclic with 1 Hz	The device is not configured
	(off)	Off	During initialisation or missing power supply

Table 71: LEDs 3964R Protocol

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10 Technical Data

10.1 Technical Data netBRICK NB 100 Gateway

NB 100	Parameter	Value
Communication controller	Type	netX 100
Memory	RAM	8 MB SDRAM
	FLASH	4 MB serial Flash
Diagnostic Interface	Socket	Mini-USB, 5-pin
Display	LED Display	SYS System Status APL Application Status COM Communication Status LINK Link ACT Activity
Power supply	Voltage	24 V ± 6 V DC
	Current at 24 V (typically)	130 mA
	Power Consumption	3.2 W
	Connector	M12 male connector, A coded
Environment	Temperature range	-20 to +70 °C
Device	Dimensions (L x W x H)	138 x 60 x 38 mm (without connectors)
	Weight	appr. 330 g
	Mounting	On a flat metal surface
	Protection Class	IP67 according to DIN EN 60529
	RoHS	Yes
CE Sign	CE Sign	Yes
	Emission	CISPR 11 class A
	Immunity	EN 61131-2:2003
Certification according UL	The device is UL 1604, UL 804 and UL 508 certified	UL-File-Nr. E326833, Project 10CA56304 July 22, 2011
	Enviroment	Pollution Degree 2
	Explosion Hazard	Class I, Division 2, Groups A, B, C and D or for non explosive areas
Configuration	Software	SYCON.net
Connections	M12 according to DIN EN 61076-2-101/ IEC 61076-2-101	

Table 72: Technical Data NB 100 (Part 1)

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DECLARATION OF CONFORMITY

Manufacturers Name:	Hilscher Gesellschaft für Systemautomation mbH
Address:	Rheinstraße 15, DE 65795 Hattersheim, Germany

declares that the product

Product Name:	netBRICK
Trade Name:	Gateway for Harsh Enviroments
Type of Model:	NB 100-aa-bb

Confirms to 47 CFR, Part 15, Subpart B of the FCC rules

Operation is subject to the following two conditions:

(1) This device may not cause harmful interference

(2) This device must accept any interference received, including interference that may cause undesired operation

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NB 100	Parameter	Value
Ethernet Interface for the device types: NB 100-RE-DP, NB 100-RE-CO, NB 100-RE-DN	Transmission rate	100 MBit/s 10 MBit/s (depending on loaded firmware)
	Interface Type	100 BASE-TX, isolated 10 BASE-TX (depending on loaded firmware), isolated
	Half duplex/Full duplex	supported (at 100 MBit/s)
	Auto-Negotiation	supported (depending on loaded firmware)
	Auto-Crossover	supported
	Connector	M12 female connector D coded
PROFIBUS Interface for the device type NB 100-RE-DP, NB 100-RS-DP	Transmission rate	9,6 kBit/s, 19,2 kBit/s, 31,25 kBit/s, 45,45 kBit/s, 93,75 kBit/s, 187,5 kBit/s, 500 kBit/s, 1,5 MBit/s, 3 MBit/s, 6 MBit/s, 12 MBit/s
	Interface Type	RS 485, optically isolated
	Connector	M12 B coded, male and female connector
CANopen Interface for the device type NB 100-RE-CO, NB 100-RS-CO	Transmission rate	10 kBit/s, 20 kBit/s, 50 kBit/s, 100 kBit/s, 125 kBit/s, 250 kBit/s, 500 kBit/s, 800 kBit/s, 1 MBit/s
	Interface Type	ISO 11898, optically isolated
	Connector	M12 A coded, male and female connector
DeviceNet Interface for the device type NB 100-RE-DN, NB 100-RS-DN	Transmission rate	125 kBit/s, 250 kBit/s, 500 kBit/s
	Interface Type	ISO 11898, optically isolated
	Connector	M12 A coded, male and female connector

Table 73: Technical Data NB 100 (Part 2)

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NB 100	Parameter	Value
Serial Interfaces for the device types: NB 100-RS-CO, NB 100-RS-DN, NB 100-RS-DP	Interface Type	RS-232, RS-422, RS-485, optically isolated
	Transmission rate ASCII	300 Bit/s 600 Bit/s 1200 Bit/s 2400 Bit/s 4800 Bit/s 9600 Bit/s 19200 Bit/s 38400 Bit/s 57600 Bit/s 115200 Bit/s
	Transmission rate Modbus RTU	4800 Bit/s 9600 Bit/s 19200 Bit/s 38400 Bit/s 57600 Bit/s 115200 Bit/s
	Transmission rate 3964R	300 Bit/s, 600 Bit/s, 1200 Bit/s, 2400 Bit/s, 4800 Bit/s, 9600 Bit/s, 19200 Bit/s, 38400 Bit/s, 57600 Bit/s, 115200 Bit/s
	Connector	M12, B coded, male or female connector

Table 74: Technical Data NB 100 (Part 3)

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10.2 Technical Data Real-Time Ethernet Protocols

10.2.1 EtherCAT Master

Parameter	Description
Maximum number of EtherCAT slaves	Maximum 200 Slaves
Maximum number of cyclic input data	5760 bytes
Maximum number of cyclic output data	5760 bytes
Minimum bus cycle time	1 ms (fix)
Topology	Line
Baud rate	100 MBit/s
Data transport layer	Ethernet II, IEEE 802.3
Configuration File (ethercat.xml)	Maximum 1 MByte
Limitations	CoE-Upload, CoE-Download for user data transfer not supported The size of the bus configuration file is limited by the size of the RAM Disk (1 Megabyte) Only Ethernet Port 0 of the device is used for communication All CoE Uploads, Downloads and information services must fit in one TLR-Packet. Fragmentation is not supported Support of Distributed clocks (Slave synchronisation) is always activated The bus cycle time is fixed to a value of 1000 µs The watchdog time is fixed to a value of 20 ms
Reference to stack version	V2.4.x.x

Table 75: Technical Data EtherCAT Master Protocol

10.2.2 EtherCAT Slave

Parameter	Description
Maximum number of cyclic input data	200 bytes
Maximum number of cyclic output data	200 bytes
Type	Complex Slave
FMMUs	3 (netX 100/netX 500)
SYNC Manager	4 (netX 100/500)
Baud rate	100 MBit/s
Data transport layer	Ethernet II, IEEE 802.3
Limitation	Acyclic communication not supported LRW is not supported
Reference to stack version	V2.5.x.x

Table 76: Technical Data EtherCAT Slave Protocol

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10.2.3 EtherNet/IP Scanner (Master)

Parameter	Description
Maximum number of EtherNet/IP connections	64 connections for implicit
Maximum number of total cyclic input data	5712 bytes
Maximum number of total cyclic output data	5760 bytes
Maximum number of cyclic input data	504 bytes per slave per telegram
Maximum number of cyclic output data	504 bytes per slave per telegram
IO Connection type	Cyclic, minimum 1 ms (depending on used number of connections and used number of input and output data)
UCMM, Class 3	Supported
Predefined standard objects	Identity Object Message Route Object Assembly Object Connection Manager Ethernet Link Object TCP/IP Object
Topology	Tree, Line, Ring
DLR (Device Level Ring)	Beacon based ’Ring Node’
ACD (Address Conflict Detection)	Supported
DHCP	Supported
BOOTP	Supported
Baud rates	10 and 100 MBit/s
Data transport layer	Ethernet II, IEEE 802.3
Integrated switch	Supported
Limitations	No acyclic user data communication CIP Sync Services are not implemented TAGs are not supported
Reference to stack version	V2.4.x.x

Table 77: Technical Data EtherNet/IP Scanner (Master) Protocol

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10.2.4 EtherNet/IP Adapter (Slave)

Parameter	Description
Maximum number of input data	504 bytes
Maximum number of output data	504 bytes
IO Connection (implicit)	1 exclusive owner, up to 2 listen only
IO Connection type	Cyclic, minimum 1 ms
UCMM	Supported
Predefined standard objects	Identity Object Message Route Object Assembly Object Connection Manager Ethernet Link Object TCP/IP Object
Topology	Tree, Line, Ring
DLR (Device Level Ring)	Beacon based ’Ring Node’
ACD (Address Conflict Detection)	Supported
DHCP	Supported
BOOTP	Supported
Baud rates	10 and 100 MBit/s
Data transport layer	Ethernet II, IEEE 802.3
Integrated switch	Supported
Limitations	No acyclic user data communication CIP Sync Services are not implemented TAGs are not supported
Reference to firmware/stack version	V2.6.x.x

Table 78: Technical Data EtherNet/IP Adapter (Slave) Protocol

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10.2.5 Open Modbus/TCP

Parameter	Description
Maximum number of input data	2880 Registers
Maximum number of output data	2880 Registers
Maximum number of connections	16
Acyclic communication	Read/Write Register: - Max. 125 Registers per Read Telegram (FC 3, 4, 23), - Max. 121 Registers per Write Telegram (FC 23), - Max. 123 Registers per Write Telegram (FC 16) Read/Write Coil: - Max. 2000 Coils per Read Telegram (FC 1, 2), - Max. 1968 Coils per Write Telegram (FC 15)
Modbus Function Codes	1, 2, 3, 4, 5, 6, 7, 15, 16, 23 (Function code 23 in server mode only)
Protocol Mode	Client or Server
Baud rates	10 and 100 MBit/s
Data transport layer	Ethernet II, IEEE 802.3
Reference to stack version	V2.5.x.x

Table 79: Technical Data Open Modbus/TCP Protocol

10.2.6 POWERLINK Controlled Node (Slave)

Parameter	Description
Maximum number of cyclic input data	1490 bytes
Maximum number of cyclic output data	1490 bytes
Baud rate	100 MBit/s, half-duplex
Data transport layer	Ethernet II, IEEE 802.3
Ethernet POWERLINK version	V 2
Limitation	No acyclic communication No slave to slave communication
Reference to stack version	V2.1.x.x

Table 80: Technical Data POWERLINK Controlled Node (Slave) Protocol

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10.2.7 PROFINET IO-RT-Controller

Parameter	Description
Maximum number of PROFINET IO Devices	128
Maximum number of total cyclic input data	5712 bytes
Maximum number of total cyclic output data	5760 bytes
Maximum number of cyclic input data	1024 bytes per device (= IOCR data length)
Maximum number of cyclic output data	1024 bytes per device (= IOCR data length)
Supported Protocols	RTC – Real Time Cyclic Protocol, Class 1 RTA – Real Time Acyclic Protocol DCP – Discovery and configuration Protocol CL-RPC – Connectionless Remote Procedure Call
Context management by CL-RPC	Supported
Minimum cycle time	1 ms Different IO-Devices can be configured with different cycle times
Baud rate	100 MBit/s Full-Duplex mode
Data transport layer	Ethernet II, IEEE 802.3
Configuration File	Maximum 1 MByte
Limitations	Read/Write Record not supported No Alarm processing RT over UDP not supported Multicast communication not supported DHCP is not supported Only one IOCR per IO Device NameOfStation of IO Controller CANNOT be set using the DCP SET NameOfStation service but only at start-up while configuring the IO Controller SNMP not supported LLDP not supported The buffer for IO-Device diagnosis data will be overwritten in case of multiple diagnostic events. Only one (the last) event is stored at the same time. If a single event produces more than 200 bytes of diagnosis data, only the first 200 bytes will be taken care of. The usable (minimum) cycle time depends on the number of used IO Devices, the number of used input and output data. The cycle-time, the number of configured IO Devices and the amount of IO data depend on each other. For example it is not possible due to performance reasons to have 128 IO Devices communication with cycle-time 1ms. The size of the bus configuration file is limited by the size of the RAM Disk (1 MByte) Only one API (API = 0) is supported. Any Profile requesting a different API is currently not supported. The IO-Device feature “FastStartUp” can not be used WriteMultiple-Record service is not supported
Reference to stack version	V2.4.x.x

Table 81: Technical Data PROFINET IO RT Controller

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10.2.8 PROFINET IO-RT-Device

Parameter	Description
Maximum number of cyclic input data	1024 bytes
Maximum number of cyclic output data	1024 bytes
Supported protocols	RTC – Real Time Cyclic Protocol, Class 1 and 2 (unsynchronized) RTA – Real Time Acyclic Protocol DCP – Discovery and configuration Protocol CL-RPC – Connectionless Remote Procedure Call LLDP – Link Layer Discovery Protocol SNMP – Simple Network Management Protocol
Used Protocols (subset)	UDP, IP, ARP, ICMP (Ping)
Topology recognition	LLDP, SNMP V1, MIB2, physical device
VLAN- and priority tagging	yes
Context Management by CL-RPC	Supported
Minimum cycle time	1 ms for RTC1 and RTC2
Baud rate	100 MBit/s
Data transport layer	Ethernet II, IEEE 802.3
Limitations	No acyclic user data transfer RT over UDP not supported Multicast communication not supported DHCP is not supported RT Class 2 synchronized (IRT “flex”) is not supported RT Class 3 synchronized not supported FastStartUp is not supported. Media Redundancy is not supported Access to the submodule granular status bytes (IOCS) is not supported. The amount of configured IO-data influences the minimum cycle time that can be reached. Supervisor-AR is not supported, Supervisor-DA-AR is supported Only 1 Input-CR and 1 Output-CR are supported Multiple WriteRequests are not supported
Reference to stack version	V3.4.x.x

Table 82: Technical Data PROFINET IO RT Device Protocol

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10.2.9 sercos Master

Parameter	Description
Maximum number of cyclic input data	5760 bytes (including Connection Control per Connection)
Maximum number of cyclic output data	5760 bytes (including Connection Control per Connection)
Maximum number of configured slave devices	511
Minimum cycle time	250 µs
Acyclic communication	Service channel: Read/Write/Commands (for configuration only)
Functions	Bus Scan
Communication phases	NRT, CP0, CP1, CP2, CP3, CP4
Topology	Line and double ring
Redundancy	supported
Baud rate	100 MBit/s, full duplex
Data transport layer	Ethernet II, IEEE 802.3
Auto crossover	supported
Supported sercos version	Communication Specification Version 1.1.1/1.1.2
Limitations	No acyclic user data transfer NRT channel not supported Hot-Plug not supported Cross Communication not supported Ring healing (needed for redundancy) is only available if the Master has a configuration
Reference to stack version	V2.0.x.x

Table 83: Technical Data sercos Master Protocol

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10.2.10 sercos Slave

Parameter	Description
Maximum number of cyclic input data (Tx)	128 bytes (including Connection Control and IO Status)
Maximum number of cyclic output data (Rx)	128 bytes (including Connection Control and IO Control)
Maximum number of slave devices	1
Maximum number of applicable sercos addresses	1 … 511
Minimum cycle time	250 µs
Topology	Line and ring
Communication phases	NRT, CP0, CP1, CP2, CP3, CP4
Baud rate	100 MBit/s
Data transport layer	Ethernet II, IEEE 802.3
Supported sercos version	sercos in the third generation Communication Specification Version 1.1.2
Supported sercos Communication Profiles	SCP_FixCFG Version 1.1.1 SCP_VarCFG Version 1.1.1 SCP_VarCFG Version 1.1.3
Supported FSP profiles	FSP_IO
SCP_NRTPC support	Yes
S/IP support	Yes
Identification LED feature supported	Yes
Limitations	Max. 2 connections: 1 for consumer and 1 for producer No acyclic user data transfer Modifications of the Service-Channel Object Dictionary will be volatile after reset, if it resides on device Hot plug is not supported Cross communication not supported NRT Channel only forwarding and S/IP
Reference to stack version	V3.1.x.x

Table 84: Technical Data sercos Slave Protocol

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10.3 Technical Data Fieldbus Protocols

10.3.1 CANopen Master

Parameter	Description
Maximum number of CANopen nodes	126
Maximum number of cyclic input data	3584 bytes
Maximum number of cyclic output data	3584 bytes
Maximum number of receive PDOs	512
Maximum number of transmit PDOs	512
Exchange of process data	Via PDO transfer: - synchronized, - remotely requested and - event driven (change of date)
Functions	Emergency message (consumer) Node guarding / life guarding, heartbeat PDO mapping NMT Master SYNC protocol (producer) Simple boot-up process, reading object 1000H for identification
Baud rates	10 kBits/s, 20 kBits/s, 50 kBits/s, 100 kBits/s, 125 kBits/s, 250 kBits/s, 500 kBits/s, 800 kBits/s, 1 MBits/s
Data transport layer	CAN Frames
CAN Frame type for CANopen	11 Bit
Limitations	SDO-Upload/Download for user data transfer not supported
Reference to stack version	V2.9.x.x

Table 85: Technical Data CANopen Master Protocol

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10.3.2 CANopen Slave

Parameter	Description
Maximum number of cyclic input data	512 bytes Objects 2200, 2201, 2202, 2203 each with up to 128 bytes
Maximum number of cyclic output data	512 bytes Objects 2000, 2001, 2002, 2003 each with up to 128 bytes
Maximum number of receive PDOs	64
Maximum number of transmit PDOs	64
Exchange of process data	Via PDO transfer - synchronized, - remotely requested and - event driven (change of date, event timer)
Functions	Node guarding / life guarding, heartbeat PDO mapping NMT Slave SYNC protocol (consumer) SDO upload/download (server, for configuration) Emergency message (producer)
Baud rates	10 kBits/s, 20 kBits/s, 50 kBits/s, 100 kBits/s, 125 kBits/s, 250 kBits/s, 500 kBits/s, 800 kBits/s, 1 MBits/s Auto baudrate detection is supported
Data transport layer	CAN Frames
CAN Frame type for CANopen	11 Bit
Limitations	Timestamp (producer/consumer) not supported on application level.
Reference to stack version	V3.0.x.x

Table 86: Technical Data CANopen Slave Protocol

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10.3.3 DeviceNet Master

Parameter	Description
Maximum number of DeviceNet slaves	63
Maximum number of total cyclic input data	3584 bytes
Maximum number of total cyclic output data	3584 bytes
Maximum number of cyclic input data	255 bytes/connection
Maximum number of cyclic output data	255 bytes/connection
Maximum configuration data	1000 bytes/slave
Baud rates	125 kBits/s, 250 kBit/s, 500 kBit/s Auto baudrate detection is not supported
Data transport layer	CAN frames
Connections	Bit Strobe Change of State Cyclic Poll Explicit Peer-to-Peer Messaging
Function	Quick Connect
Fragmentation	Explicit and I/O
Function	Proxy for explicit messaging for user communication to all ‚group 2 only' slaves
UCMM	Supported
Objects	Identity Object (Class Code 0x01) Message Router Object (Class Code 0x02) DeviceNet Object (Class Code 0x03) Connection Object (Class Code 0x05) Acknowledge Handler Object (Class Code 0x06)
Baud rates	125 kBits/s, 250 kBit/s, 500 kBit/s Auto baudrate detection is not supported
Data transport layer	CAN frames
Limitations	User data transfer through the gateway only via IO connections
Reference to stack version	V2.3.x.x

Table 87: Technical Data DeviceNet Master Protocol

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10.3.4 DeviceNet Slave

Parameter	Description
Maximum number of cyclic input data	255 bytes
Maximum number of cyclic output data	255 bytes
Connections	Poll Change-of-state Cyclic Bit-strobe
Fragmentation	Explicit and I/O
UCMM	Not supported
Baud rates	125 kBits/s, 250 kBit/s, 500 kBit/s Auto baudrate detection is not supported
Data transport layer	CAN frames
Limitations	Access to Application Object only via IO connection
Reference to stack version	V2.3.x.x

Table 88: Technical Data DeviceNet Slave Protocol

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10.3.5 PROFIBUS DP Master

Parameter	Description
Maximum number of PROFIBUS DP slaves	125
Maximum number of total cyclic input data	5712 bytes
Maximum number of total cyclic output data	5760 bytes
Maximum number of cyclic input data	244 bytes/slave
Maximum number of cyclic output data	244 bytes/slave
Configuration data	Max. 244 bytes per slave
Parameterization data per slave	7 bytes/slave standard parameters Max. 237 bytes/slave application specific parameters
Baud rate	9,6 kBits/s, 19,2 kBits/s, 31,25 kBits/s, 45,45 kBits/s 93,75 kBits/s, 187,5 kBits/s, 500 kBits/s, 1, 5 MBits/s, 3 MBits/s, 6 MBits/s, 12 MBit/s Auto baud rate detection is not supported
Data transport layer	PROFIBUS FDL
Limitations	DP V1 services class 1 and 2 are not supported DP V2 services are not supported
Reference to stack version	V2.5.x.x

Table 89: Technical Data PROFIBUS DP Master Protocol

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10.3.6 PROFIBUS DP Slave

Parameter	Description
Maximum number of cyclic input data	244 bytes
Maximum number of cyclic output data	244 bytes
Maximum number of modules	Max. 4 input modules and max. 4 output modules, max. 24 modules when using manual setting
Baud rate	9,6 kBits/s, 19,2 kBits/s, 31,25 kBits/s, 45,45 kBits/s 93,75 kBits/s, 187,5 kBits/s, 500 kBits/s, 1, 5 MBits/s, 3 MBits/s, 6 MBits/s, 12 MBit/s Auto baudrate detection is supported
Data transport layer	PROFIBUS FDL
Limitations	DP V1 services class 1 and 2 to transfer user data are not supported SSCY1S – Slave to slave communication state machine not implemented Data exchange broadcast not implemented I&M0 with fixed settings only
Reference to firmware/stack version	V2.4.x.x

Table 90: Technical Data PROFIBUS DP Slave Protocol

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10.4 Technical Data serial Protocols

10.4.1 ASCII

Parameter	Description and Value Range
Maximum telegram length	1024 bytes
Data bits	7, 8 bits
Stop bits	1, 2 bit(s)
Parity	None, even, odd
Baud rate	300 bit/s, 600 bit/s, 1200 bit/s, 2400 bit/s, 4800 bit/s, 9600 bit/s, 19200 bit/s, 38400 bit/s, 57600 bit/s, 115200 bit/s
Duplex	Half-duplex
Flow control	None
Indicator for end of received telegram	On receipt of a fixed number of characters On receipt of termination character(s) Elapse of character delay time
Timing parameter	Response timeout Receive watchdog time Send cycle time Character delay time
Number of send buffers	1
Number of receive buffers	1
Number of transmission retries	1
Maximum number of structure elements of a send telegram	10
Maximum number of structure elements of a receive telegram	10
Structure elements	Start character(s), Device address, Object index or start address, Command identifier, Data area with length information, Data area with termination character(s), End character(s), Checksum, Character(s) without meaning (fix length)
Checksum methods	CRC8, CRC16, CRC32, Exor
Reference to stack version	V1.0.x.x

Table 91: Technical Data ASCII Protocol

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10.4.2 Modbus RTU Master/Slave

Parameter	Description and Value Range
Maximum number of input data	2880 Registers
Maximum number of output data	2880 Registers
Acyclic communication	Read/Write Register, Maximum 125 Registers per Read Telegram (FC 3, 4), Maximum 123 Registers per Write Telegram (FC 16), Maximum 118 Registers per Write Telegram (FC 23), Maximum 118 Registers per Read Telegram (FC 23) Read/Write Coil, Maximum 2000 Coils per Read Telegram (FC 1, 2), Maximum 1968 Coils per Write Telegram (FC 15)
Function Codes Modbus Master	1, 2, 3, 4, 5, 6, 15, 16
Function Codes Modbus Slave	1, 2, 3, 4, 5, 6, 7, 8, 15, 16, 23
Mode	Modbus Master or Modbus Slave
Modbus Address	1 ... 247
Baud rates	1200 bit/s, 2400 bit/s, 4800 bit/s, 9600 bit/s, 19200 bit/s, 38400 bit/s, 57600 bit/s, 115200 bit/s
Data bits	8 bits
Stop bits	1, 2 bit(s)
Parity	None, even, odd
Limitations	Broadcast not supported
Reference to stack version	V1.3.x.x

Table 92: Technical Data Modbus RTU Protocol

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10.4.3 3964R

Parameter	Description and Value Range
Maximum Telegram Length	5736 bytes
Data Bits	7, 8 bits
Stop Bits	1, 2 bit(s)
Parity	None, even, odd
Baud Rate	300 bit/s, 600 bit/s, 1200 bit/s, 2400 bit/s, 4800 bit/s, 9600 bit/s, 19200 bit/s, 38400 bit/s, 57600 bit/s, 115200 bit/s
Duplex	Half-duplex
Priority	Adjustable: High or low Priority
Timing Parameter	Acknowledge Timeout Character Delay Time
Number of Send Buffers	1
Number of Receive Buffers	Ring Buffer with 30 buffers (FIFO)
Number of Transmission Retries	Adjustable
Checksum Method	BCC
Reference to stack version	V0.9.x.x

Table 93: Technical Data 3964R Protocol

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11 Wiring Instructions

Please note the wiring instructions for the corresponding protocol specifications, otherwise a perfect function of the device is not guaranteed.

11.1 PROFIBUS

Please ensure that termination resistors are available at both ends of the cable. If special PROFIBUS connectors are being used, these resistors are often found inside the connector and must be switched on. For baud rates above 1.5 MBaud use only special connectors, which also include additional inductance.

It is not permitted to have T-stubs on PROFIBUS high baud rates. Use only a special cable which is approved for PROFIBUS-DP. Make a solid connection from the cable shield to ground at every device and make sure that there is no potential difference between the grounds at the devices.

If the Hilscher device is linked with only one other device on the bus, they must be at the ends of the bus line. The reason is that these devices must deliver the power supply for the termination resistors. Otherwise the Master can be connected at any desired position.

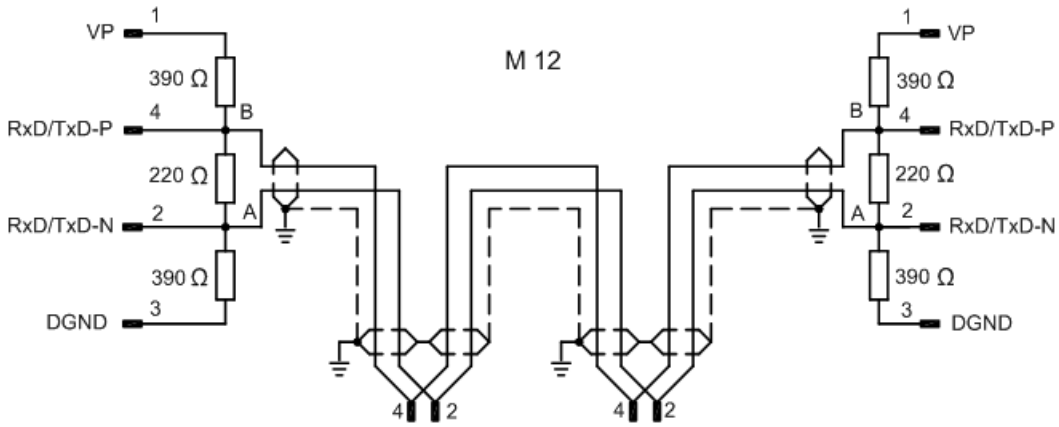

Figure 25: PROFIBUS-DP Network M12 Pinning

The figure shows the pinning for M12 connectors. Please note that the pinning differs from the figure above for other connector types.

Up to 32 PROFIBUS devices can be connected to one bus segment. If several bus segments are linked to each other with repeaters, there can be up to 127 devices on the network.

Only PROFIBUS certified cable, preferably the cable type A, should be used.

The maximum length of a bus segment depends on the baud rate used, see *Table 94: PROFIBUS Segment Length in Dependence of the Baud Rate* on page 105.

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Baud rate in kBit/s	Max. distance in m
9,6	1.200
19,2	1.200
93,75	1.200
187,5	1.000
500	400
1.500	200
3.000	100
6.000	100
12.000	100

Table 94: PROFIBUS Segment Length in Dependence of the Baud Rate

The following table contains the most important electrical dsata concerning PROFIBUS certified cable:

Parameter	Value
Impedance	135…165 Ω
Capacity	< 30 pF/m
Loop resistance	110 Ω/km
Wire gauge	0,64 mm

Table 95: Characteristics of PROFIBUS certified Cable

For the pinout for PROFIBUS see section *X3 PROFIBUS Interface* on page 36.

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11.2 CANopen

Please use only CAN certified cable with the following characteristics:

Parameter	Value
Impedance	120 Ω ± 12 Ω
Capacity	< 50 pF/m

Table 96: Characteristics of CAN certified Cable

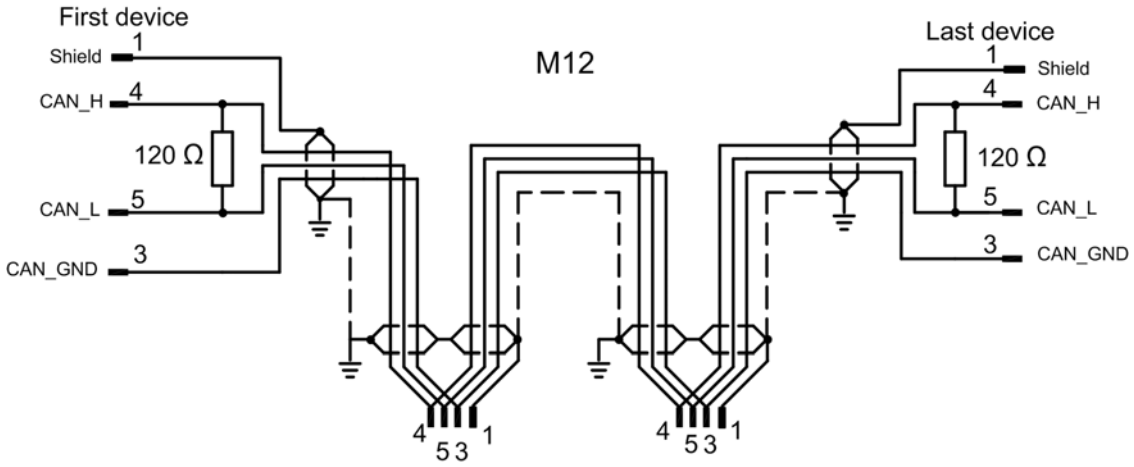

Figure 26: Termination CANopen Network

The pin numbers inthe figure above refer to M12 connectors. If you use devices in the network with other types of connectors, take care that the pin numbers of those devices can be different from the figure above.

At the ends of the network there must be two resistors of 120 Ω to terminate the cable. It is allowed to use repeaters to increase the number of nodes, which may be connected, or to increase the maximum cable length.

The CAN segment length in dependence of the Baud rate or corresponding Loop Resistance and Wire Gauge is given in the following table:

Baud rate in kBit/s s	Max. distance	Loop Resistance	Wire Gauge
10	1000 m	<26 Ω/km	0,75...0,80 mm^2
20	1000 m	<26 Ω/km	0,75...0,80 mm^2
50	1000 m	<26 Ω/km	0,75...0,80 mm^2
125	500 m	<40 Ω/km	0,50...0,60 mm^2
250	250 m	<40 Ω/km	0,50...0,60 mm^2
500	100 m	<60 Ω/km	0,34...0,60 mm^2
800	50 m	<60 Ω/km	0,34...0,60 mm^2
1.000	30 m	70 Ω/km	0,25...0,34 mm^2

Table 97: CAN Segment Length in dependence of the Baud rate or corresponding Loop Resistance and Wire Gauge

For the pinout for CANopen see section *X3 CANopen Interface* on page 37.

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11.3 DeviceNet

Up to 64 DeviceNet devices can be linked together over the bus. The maximum length of the bus cable depends on the used baud rate and the used cable type. Only special proved DeviceNet cable should be used.

The maximum length of the DeviceNet cable depends from the baud rate and from the chosen cable type. In the following table, these are listed in the following table:

Baudrate in kbit/s	Maximum length of cable (thick cable)	Maximum length of cable (thick cable)
125	500 m	100 m
250	250 m	100 m
500	100 m	100 m

Table 98: Maximum length in dependence from the Baud Rate for DeviceNet Cables

The data line cables must match the following conditions:

Data line cable		Impedance	Capacity	Loop Resistance	Wire Gauge (Diameter)
Thick		120 Ohm	<39,4 pf/m	<22,6 Ohm/km	2 * 1.1 mm
Thin		120 Ohm	<39,4 pf/m	<91,8 Ohm/km	2 * 0,6 mm

Table 99 Characteristics of DeviceNet Data Line Cable

The power supply cables must match the following conditions:

Power supply cable		Loop Resistance	Wire Gauge (Diameter)
Thick		<11,8 Ohm/km	2 * 1.4 mm
Thin		<57,4 Ohm/km	2 * 0,7 mm

Table 100: Characteristics of DeviceNet Power Supply Cable

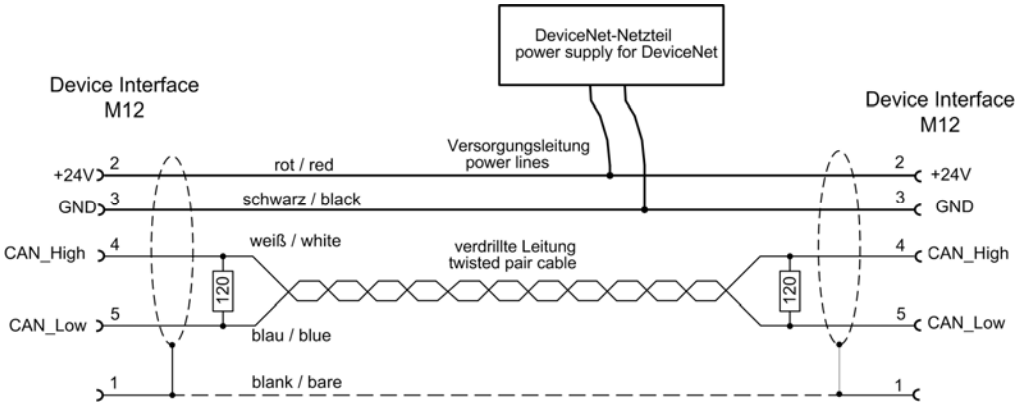

Figure 27: DeviceNet Network with M12 Connectors

Please ensure that termination resistors with 120 Ohm are available at both ends of the cable.

Further devices can be connected via T-stubs to the bus cable. The maximum length of all T-stubs is 6 m. The whole length of the bus cable and all T-stubs does not exceed the maximum length listed in the following table.

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There are two different types of cables. If both cables types are used within the same network, the maximum length is:

Max. distance	Baud rate in kBits/s
L_{thick} + 5 x L_{thin} <= 500 m	at 125 kBaud
L_{thick} + 2,5 x L_{thin} <= 250 m	at 250 kBaud
L_{thick} + L_{thin} <= 100 m	at 500 kBaud

Table 101: DeviceNet Segment Length in dependence of the Baud rate

The DeviceNet cable contains the data line cables and the power supply cables.

For the pinout for DeviceNet see section *X3 DeviceNet Interface* on page 38.

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11.4 Ethernet

For the pinout for Ethernet see section *X2 Ethernet Connection* on page 34.

Use of Hubs and Switches

For the corresponding communication systems, the use of hubs and/or switches is either forbidden or allowed. The following table shows the acceptable use of hubs and switches by each communication system:

Communication System	Hub	Switch
EtherCAT	forbidden	only allowed between EtherCAT Master and first EtherCAT Slave (100 MBit/s, Full Duplex)
EtherNet/IP	allowed	allowed (10 MBit/s/100 MBit/s, Full or Half Duplex, Auto-Negotiation)
Open Modbus/TCP	allowed	allowed (10 MBit/s/100 MBit/s, Full or Half Duplex, Auto-Negotiation)
POWELINK	allowed	forbidden
PROFINET IO RT	forbidden	Only allowed, if the switch supports ‚Priority Tagging' and LLDP (100 MBit/s, Full Duplex)
sercos	forbidden	forbidden

Table 102: Use of Hubs and Switches

NOTICE

Failure of the Network Communication

- Do not operate hardware with the communication controllers netX 50, netX100 or netX 500 with the protocols Ethernet TCP/UDP/IP, EtherNet/IP or Modbus TCP at 10 MBit/s in half-duplex mode, otherwise failure of the network communication can occure.
- Use only switches or 10/100 MBit/s dual-speed hubs and ensure that the network operates at 100 MBit/s and in full-duplex mode.

For further information refer to section *Failure in 10 MBit/s Half Duplex Mode and Workaround* on page 62.

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11.5 RS-232

The RS232 interface (EIA-232) is a point-to-point connection of two communication devices. Only shielded cables have to be used. No termination resistors are required.

Take care of the pin assignment at the communication partner. This decides, whether you need a so called null modem cable with crossed pin assignments.

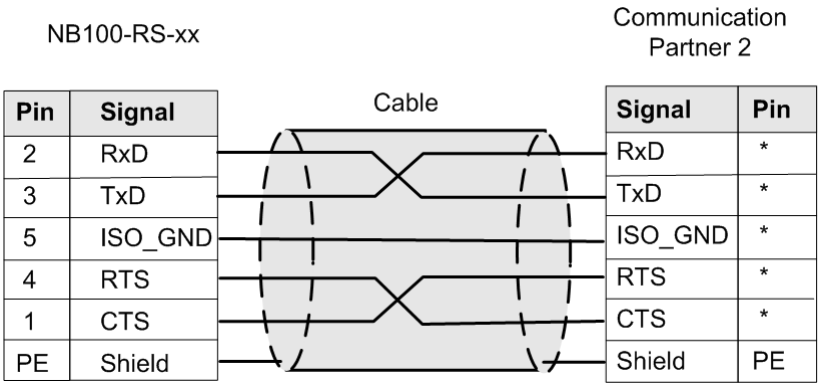

Figure 28: RS-232 Null-Modem Cable Connection

* Pinout for the communication partner: See device description of the used device.

Take into consideration the setting for *RTS Control* in the parameters of the used protocol (Modbus RTU, ASCII and 3964R).

Parameter RTS Control	Cable / Remote Device (Communication Partner)
RTS Control Off	No wires for CTS and RTS are needed in the cable.
RTS Control On	Wires for CTS and RTS are needed in the cable.

Conductor length and transmission rates

In the EIA-232 norm a maximum cable capacitance of 2500 pF is allowed for a RS232 connection.

Cables of such capacitance may have the following lengths depending on the baud rate

max. baud rate	max. Length
19.200	15 m
57.600	5 m
115.200	<2 m

Higher length can be achieved with cables of extraordinarily low capacitance.

For the pinout for the serial interface see section *X2 Serial Connection* on page 35.

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11.6 RS-422

The lines of this industry bus interface are operated in push-pull action, four lines are required which can be controlled in half duplex or full duplex mode. This interface has been designed for one master and at maximum 10 slaves. Using repeaters, using even more slaves is possible.

Cable lengths of up to 1.2 km (at low baud rates) and data transmission rates of up to 10 MBit/s (at maximally 12 m length of line) are possible. The maximum useable transmission rate depends on the technical data of the used devices.

The following illustration shows wiring for RS-422:

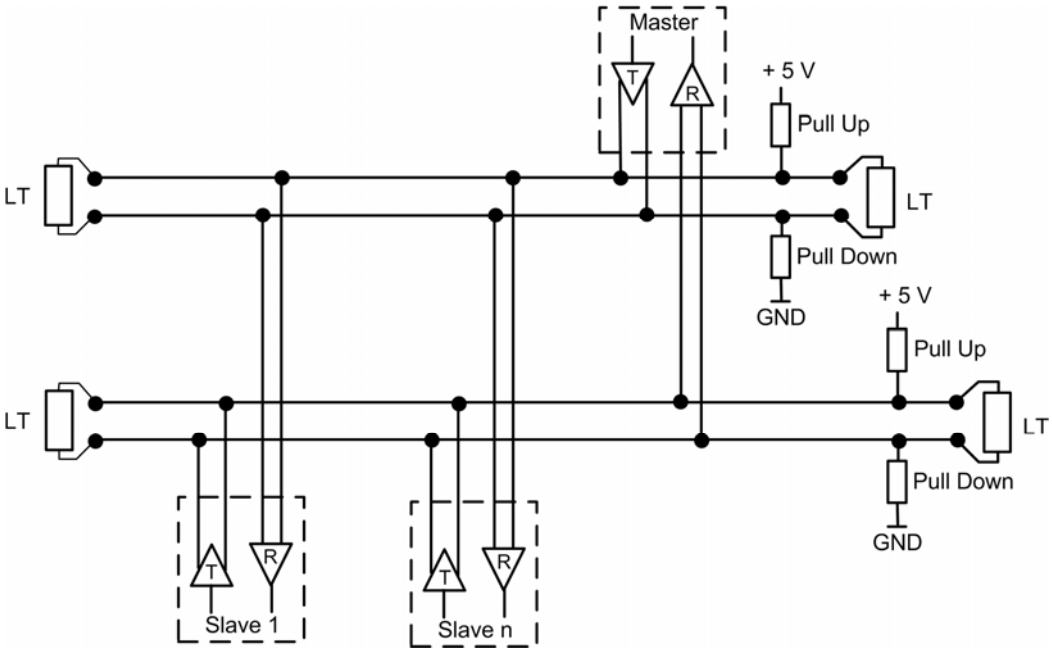

Figure 29: RS-422 Wiring

Bus Requirements:

The bus cable must be a shielded 4.wire twisted pair cable. Each pair of wires has to be used for exactly one data transmission direction. The shield should be connected at both ends to the potential equalization system.

On each end, the bus requires a termination resistor (LT) of 90 Ω to 150 Ω between the lines. This value depends on the characteristic wave impedance of the cable.

The pull-up and pull-down resistors should have a resistance of 390 Ω up to 650 Ω.

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Cable Requirements:

The workmanship of bus cabling is an important factor of the reliable operation and also for the electromagnetic compatibility and emission. It is mandatory to use shielded twisted-pair cables. The shield of the cable must consist of a copper wire mesh.

Parameter	Value
Characteristic wave impedance	150 Ω ± 15 Ω
Capacitance	< 30 pF/m
Loop resistance	110 Ω/km
Wire gauge	0,64 mm

Table 103: Electric Requirements to RS-422 Cables

The following lengths of lines can be achieved:

Max. overall length of line	Max. Baud rate	Max. length of a single branch line
120 m	1 MBit/s	0,3 m
600 m	500 kBit/s	0,6 m
1200 m	100 kBit/s	1,5 m

Table 104: RS-422 Conductor Length and Transmission Rates

For the pinout for the serial interface see section *X2 Serial Connection* on page 35.

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11.7 RS-485

The lines of this industry bus interface are operated in push-pull action, only two lines are required which can be controlled in half duplex or full duplex mode. The advantage of the 2-wire technology mainly consists in the multi-master capability. In principle, each participant is able to exchange data with any other participant. However, synchronous send attempts of two or more participants must be prevented by the applied protocol. The RS-485 interface allows the connection of up to 32 transmitters and receivers using a protocol. (With repeaters even more participants are possible.)

Nowadays, RS-485 supports cable lengths of up to 1.2 km (see *Table 106: RS-485 Cable* Lengths on page 114) and data transmission rates of up to 1 MBit/s. The maximum useable transmission rate depends on the technical data of the used devices.

The following illustration shows wiring for RS-485:

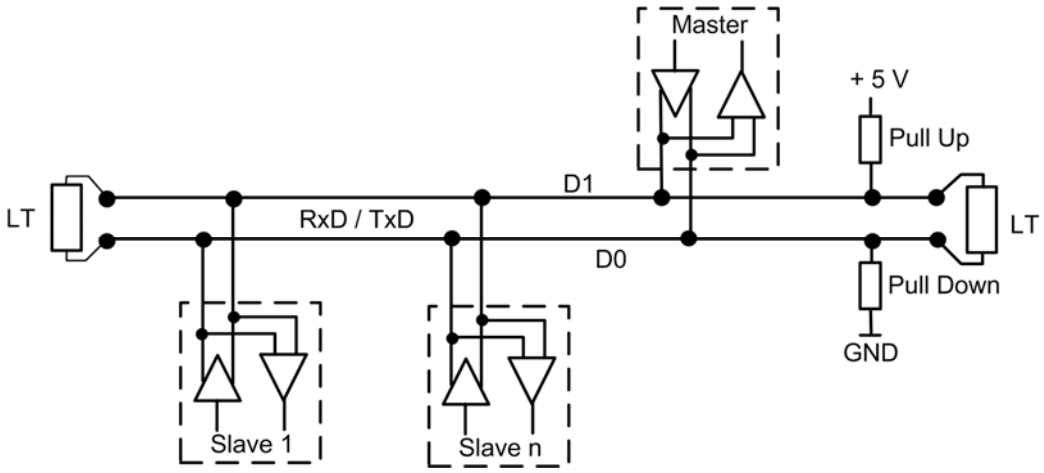

Figure 30: RS-485 Wiring

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Bus requirements:

The bus cable must be a shielded twisted pair cable where the shield should be connected at both ends with large contact areas to the potential equalization system.

On each end, the bus requires a termination resistor (LT) between the lines D1 und D0 of approximately the amount of the characteristic wave impedance of the cable, which usually amounts to a value between 120 Ω and 220 Ω.

The pull-up and pull-down resistors should have a value of 390 Ω up to 650 Ω.

Cable requirements:

The workmanship of bus cabling is an important factor of the reliable operation and also for the electromagnetic compatibility and emission. It is mandatory to use shielded twisted-pair cables. The shield of the cable must consist of a copper wire mesh.

Parameter	Value
Characteristic wave impedance	150 Ω ± 15 Ω
Capacitance	< 30 pF/m
Loop resistance	110 Ω/km
Wire gauge	0,64 mm

Table 105: Electric Requirements to RS-485 Cables

The following lengths of lines can be achieved:

Max. overall length of line	Max. Baud rate	Max. length of a single branch line
120 m	1 MBit/s	0,3 m
600 m	500 kBit/s	0,6 m
1200 m	100 kBit/s	1,5 m

Table 106: RS-485 Cable Lengths

For the pinout for the serial interface see section *X2 Serial Connection* on page 35.

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12 Decommissioning/Disposal

12.1 Decommissioning

Obey to the following safety messages, when decommissioning the netBRICK NB 100 device.

WARNING

Danger of unsafe System Operation!

- To prevent harm of persons and property damage, do not remove this device under runtime conditions before you can not guarantee further a safe and secure operation of the plant.

NOTICE

Danger of unsafe System Operation!

- To prevent property damage, do not remove this device under runtime conditions before you can not guarantee further a safe and secure operation of the plant.

Refer also to the notes in the section„*Dismounting*“ on page 49.

12.2 Disposal of Waste Electronic Equipment

According to the European Directive 2002/96/EG “Waste Electrical and Electronic Equipment (WEEE)”, waste electronic equipment may not be disposed of as household waste. As a consumer, you are legally obliged to dispose of all waste electronic equipment according to national and local regulations.

Waste Electronic Equipment

- This product must not be treated as household waste.
- This product must be disposed of at a designated waste electronic equipment collecting point.

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13 Glossary

Auto-Crossover

Auto-Crossover is a feature of an interface: An interface with Auto-Crossover capability will automatically detect and correct if the data lines have been exchanged vice versa.

Baud rate

Data transmission speed of a communication channel or interface.

Boot loader

Program loading the firmware into the memory of a device in order to be executed.

Division 2

HAZARD Division 2: The presence of explosive gas os less than 10 hours per year.

EtherCAT

A communication system for industrial Ethernet designed and developed by Beckhoff Automation GmbH.

EtherNet/IP

A communication system for industrial Ethernet designed and developed by Rockwell. It partly uses the CIP (Common Industrial Protocol).

Ethernet Powerlink

A communication system for industrial Ethernet designed and developed by B&R. It partly uses CANopen technologies.

Gateway

A device interfacing between two different communication standards.

GND

Reference potential

Groups

Groups A, B, C, D denotes classes of substances with different hazard potential.

Hazard Class I

Class I is hazardous area

ISO GND

Isolated reference potential, isolated from other device areas.

PE

Potential equalization line, Potential equalization line of the process plant.

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Pollution Degree 2

Usually only electrically non-conductive pollution occur. Occasionally, temporarily electrical conductivity caused by condensation must be reckoned.

PROFINET

A communication system for Industrial Ethernet designed and developed by PROFIBUS International. It uses some mechanisms similar to those of the PROFIBUS field bus.

Real-Time Ethernet

Real-Time Ethernet (also denominated as *Industrial Ethernet*) is an extension of the Ethernet networking technology for industrial purposes with very good Real-Time features and performance. There is a variety of different Real-Time Ethernet systems on the market which are incompatible with each other. The most important systems of these are

- EtherCAT
- EtherNet/IP
- Ethernet Powerlink
- PROFINET

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14 Appendix

14.1 List of Figures

Figure 1: Function netBRICK 22
Figure 2: Dimensioned Drawing 29
Figure 3: Drilling Template 29
Figure 4: Device Label 30
Figure 5: LEDs and Control Elements NB 100-RE-XX 31
Figure 6: LEDs and Control Elements NB 100-RS-xx 32
Figure 7: Diagnostic Interface 40
Figure 8: Galvanic Isolation NB 100 RE-DP Device 41
Figure 9: Galvanic Isolation NB 100-RE-DN/CO Device 43
Figure 10: Galvanic Isolation NB 100-RS-DP Device 44
Figure 11: Galvanic Isolation NB 100-RS-DN/CO Device 45
Figure 12: USB Installation in Bootloader Mode Step 1 53
Figure 13: USB Installation in Bootloader Mode Step 2 54
Figure 14: USB Installation in Bootloader Mode Step 3 54
Figure 15: USB Installation in Bootloader Mode Step 4 55
Figure 16: USB Installation in Bootloader Mode Step 5 55
Figure 17: USB Installation in Bootloader Mode Step 6 56
Figure 18: USB Installation in Bootloader Mode Step 7 56
Figure 19: ComProX Start 57
Figure 20: ComProX Choice of Connection 57
Figure 21: ComProX Choice File Explorer 58
Figure 22: ComProX File Explorer - NB 100 File System Structure 58
Figure 23: ComProX File Explorer - File Menu 1 59
Figure 24: ComProX File Explorer - File Menu 2 59
Figure 25: PROFIBUS-DP Network M12 Pinning 104
Figure 26: Termination CANopen Network 106
Figure 27: DeviceNet Network with M12 Connectors 107
Figure 28: RS-232 Null-Modem Cable Connection 110
Figure 29: RS-422 Wiring 111
Figure 30: RS-485 Wiring 113

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14.2 List of Tables

Table 1: List of Revisions 7
Table 2: Reference to Hardware 9
Table 3: Reference to Software 9
Table 4: Reference to Driver 9
Table 5: Directory Structure of the DVD 10
Table 6: Device Description Files for netBRICK NB 100 on the DVD 11
Table 7: Basic Documentation for netBRICK NB 100 12
Table 8: Additional Documentation for netBRICK NB 100 with EtherCAT Master 12
Table 9: Additional Documentation for netBRICK NB 100 with EtherNet/IP Scanner/Master 13
Table 10: Additional Documentation for netBRICK NB 100 with PROFINET IO Controller 13
Table 11: Additional Documentation for netBRICK NB 100 with EtherCAT Master 13
Table 12: Additional Documentation for netBRICK NB 100 with CANopen Master 13
Table 13: Additional Documentation for netBRICK NB 100 with DeviceNet Master 14
Table 14: Additional Documentation for netBRICK NB 100 with PROFIBUS DP Master 14
Table 15: Additional Documentation for netBRICK NB 100 with ASCII 14
Table 16: Additional Documentation for netBRICK NB 100 with 3964R 14
Table 17: Safety Symbols and Sort of Warning or Principle 21
Table 18: Signal Words 21
Table 19: Network on Port X2 (Primary Network) 23
Table 20: Network on Port X3 (Secondary Network) 23
Table 21: Protocol Conversion - Ethernet to Fieldbus (Part 1) 24
Table 22: Protocol Conversion - Ethernet to Fieldbus (Part 2) 25
Table 23: Protocol Conversion – Serial Protocols to Fieldbus 26
Table 24: LED (20) – Labeling 31
Table 25: LED (20) – Labeling 32
Table 26: X1 Power Supply Line Pin Assignment 33
Table 27: Ethernet Pin Assignment 34
Table 28: Ethernet Pin Assignment 34
Table 29: M12 RS-232 Pin Assignment 35
Table 30: RS-422 M12 Pin Assignment 35
Table 31: RS-485 M12 Pin Assignment 35
Table 32: PROFIBUS M12 RS-485 Pin Assignment 36
Table 33: PROFIBUS M12 Pin Assignment 36
Table 34: CANopen M12 Pin Assignment 37
Table 35: CANopen M12 Pin Assignment 37
Table 36: DeviceNet M12 Pin Assignment 38
Table 37: DeviceNet M12 Pin Assignment 38
Table 38: Pin Assignment Mini-B USB Connector (5 pin) 40
Table 39: Coupling NB 100-RE-DP Device 42
Table 40: Galvanic Isolation NB 100-RE-DN/CO Device 43
Table 41: Galvanic Isolation NB 100-RS-DP Device 44
Table 42: Galvanic Isolation NB 100-RS-DN/CO Device 45
Table 43: NB 100 Troubleshooting 61
Table 44: System LED 63
Table 45: LED APL 63
Table 46: LEDs EtherCAT Master 64
Table 47: LED State Definition for EtherCAT Master for the RUN and ERR LEDs 64
Table 48: LEDs EtherCAT Slave 65
Table 49: LED State Definition for EtherCAT Slave for the RUN and ERR LEDs 66
Table 50: LEDs EtherNet/IP Scanner (Master) 67
Table 51: LEDs EtherNet/IP Adapter (Slave) 68

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Table 52: LEDs Open Modbus/TCP 69
Table 53: LEDs Powerlink Controlled Node/Slave 70
Table 54: LED State Definition for Powerlink Controlled Node/Slave for the BS/BE LEDs 71
Table 55: LEDs PROFINET IO-RT Controller 72
Table 56: LEDs PROFINET IO-RT-Device 73
Table 57: LEDs sercos Master 74
Table 58: LED State Definition for sercos Master for the STA and ERR LEDs 75
Table 59: LEDs sercos Slave 76
Table 60: LED State Definition for sercos Slave for the S3 LED (STA LED) 76
Table 61: LEDs PROFIBUS DP Master 77
Table 62: LED PROFIBUS DP Slave 77
Table 63: LED CANopen Master 78
Table 64: LED State Definition for CANopen Master for the CAN LED 78
Table 65: LEDs CANopen Slave 79
Table 66: LED State Definition for CANopen Slave for the CAN LED 79
Table 67: LEDs DeviceNet Master 80
Table 68: LEDs DeviceNet Slave 80
Table 69: LEDs Modbus RTU Protocol 81
Table 70: LEDs ASCII Protocol 81
Table 71: LEDs 3964R Protocol 82
Table 72: Technical Data NB 100 (Part 1) 83
Table 73: Technical Data NB 100 (Part 2) 85
Table 74: Technical Data NB 100 (Part 3) 86
Table 75: Technical Data EtherCAT Master Protocol 87
Table 76: Technical Data EtherCAT Slave Protocol 87
Table 77: Technical Data EtherNet/IP Scanner (Master) Protocol 88
Table 78: Technical Data EtherNet/IP Adapter (Slave) Protocol 89
Table 79: Technical Data Open Modbus/TCP Protocol 90
Table 80: Technical Data POWERLINK Controlled Node (Slave) Protocol 90
Table 81: Technical Data PROFINET IO RT Controller 91
Table 82: Technical Data PROFINET IO RT Device Protocol 92
Table 83: Technical Data sercos Master Protocol 93
Table 84: Technical Data sercos Slave Protocol 94
Table 85: Technical Data CANopen Master Protocol 95
Table 86: Technical Data CANopen Slave Protocol 96
Table 87: Technical Data DeviceNet Master Protocol 97
Table 88: Technical Data DeviceNet Slave Protocol 98
Table 89: Technical Data PROFIBUS DP Master Protocol 99
Table 90: Technical Data PROFIBUS DP Slave Protocol 100
Table 91: Technical Data ASCII Protocol 101
Table 92: Technical Data Modbus RTU Protocol 102
Table 93: Technical Data 3964R Protocol 103
Table 94: PROFIBUS Segment Length in Dependence of the Baud Rate 105
Table 95: Characteristics of PROFIBUS certified Cable 105
Table 96: Characteristics of CAN certified Cable 106
Table 97: CAN Segment Length in dependence of the Baud rate or corresponding Loop Resistance and Wire Gauge 106
Table 98: Maximum length in dependence from the Baud Rate for DeviceNet Cables 107
Table 99 Characteristics of DeviceNet Data Line Cable 107
Table 100: Characteristics of DeviceNet Power Supply Cable 107
Table 101: DeviceNet Segment Length in dependence of the Baud rate 108
Table 102: Use of Hubs and Switches 109
Table 103: Electric Requirements to RS-422 Cables 112

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Table 104: RS-422 Conductor Length and Transmission Rates 112
Table 105: Electric Requirements to RS-485 Cables 114
Table 106: RS-485 Cable Lengths 114

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